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PERCEPTION AND BEHAVIOUR OF NEPALESE HILL FARMERS TOWARDS FOREST RESOURCE USE AND CONSERVATION

by

Binod K. Shrestha

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SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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Edgar L. Jackson

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Date April 6, 1984

ABSTRACT

Owing to an increasing number of people and livestock in Nepal, forest resource demand has exceeded the regeneration capacity of the forests, leading to deforestation and degradation of the Hill environment. This problem is accentuated by the lack of an effective management system. The implementation of the community forestry programme has been slow because of various institutional and socio-cultural constraints. Meanwhile recent studies have questioned the widely held belief that deforestation is primarily caused by firewood collection.

In this study, the causes of deforestation as perceived by the Hill farmers in the mid-western region of Nepal are assessed. The patterns of forest resource use and the opinions of the rural people regarding conservation and management programmes are appraised and local conservation efforts are identified. Measures to orient the community forestry efforts to the needs and the priorities of the rural people and consequently accelerate the pace of implementation of the forestry management programmes.

The study is based on a questionnaire survey, and the approach is descriptive. The symbiotic interrelationship between the whole agro-forestry system and the effects on the environment are described to place the study in context. The existing conditions in the study area are discussed with particular emphasis on the population characteristics, land ownership, and livestock stocking and the effects of this upon the forests. The findings in the study regarding the forest resource use patterns, perceived effects of deforestation, and the management measures suggested by the respondents are presented.

It is demonstrated that livestock overgrazing and fodder collection are the principal causes of deforestation and land degradation. Nevertheless, given the interlinkages and the supportive roles among the various components of the agro-forestry system the question of firewood supply and clearing for farmland expansion should not be overlooked. To a lesser

degree they are also contributing to deforestation.

Based on the preferences mentioned and the management suggestions given by the respondents, a range of alternatives for consideration in the implementation of the community forestry programme has been developed. These focus upon four aspects of forestry management, namely increasing the forest resource supply, decreasing the forest resource demand, providing protection measures, and establishing institutional mechanisms.

More specifically the recommendations are:

a. increase the supply of fodder, particularly during the winter and the premonsoon seasons, from private planting to be supplemented by the supply from the forests;

b. reduce the demand by promoting family planning, and by decreasing livestock numbers through an increase in the productivity of individual animals;

c. decrease dependence on the forest through promotion of alternative renewable sources of energy;

d. provide protection measures in community forests by "live" and "social" fencing and encourage hand harvesting, stall feeding, and more organized systems of collection of resources to replace scavenging practices;

e. involve the local people, particularly the women and the small farmers, in the decision making and the implementation process through provision of incentives, demonstration, formation of user groups, and extension training;

f. launch an educational campaign to further publicize the benefits and the methods of forestry management in order to encourage participation and cooperation.

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Dr. L. P. Apedaile instilled in me that knowledge and understanding are worthwhile goals. This thesis is dedicated to him, Mrs. Apedaile and their children, who always made me feel a part of the family.

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I. INTRODUCTION

A. INTRODUCTION

The hills of Nepal, which support approximately 1500 persons per square kilometre of arable land and a high rate of livestock stocking, are under extreme pressure to sustain the resource demands of this increasing population. Since the early 1950s, reports have appeared concerning the "catastrophic deforestation" and "land degradation" in Nepal (Baddox, 1959; Robbe, 1954). Recent reports indicate that not only is the land degradation problem becoming more serious than ever before but the rate at which it is taking place is accelerating (Eckholm, 1975, 1976; IBRD, 1979; NPC, 1981; Spears, 1982).

It has been estimated that, as the annual forest resource demand is greater than the annual regeneration capacity, the forest area in Nepal (that is the capital stock) decreased by 35 per cent between 1965 and 1975 (Wallace, 1981). By 1977 the total supply of firewood in the Hills was less than half the total demand and extrapolated figures show that if present trends continue, by the year 2000 not only will the deficit have increased threefold but the supply of forest resources will be totally exhausted (IBRD, 1978; IDS, 1981; Sharma and Amatya, 1978).

The depleting supply of forest resources is experienced by the Nepalese Hill farmers as a gradually expanding circle of denuded hills surrounding the village, taxing the available family manpower to collect firewood, fodder and drinking water. Villagers have reported that within their lifetime, the time required to collect a backload of firewood has increased from a few hours to a full day (Bishop, 1976; Rana, 1977). Already in some villages, households may devote an average of 15 person-days per month to fodder collection and 11 person-days to firewood collection, a time which might be better spent in improving farm operations (IBRD, 1978).

Reforestation programmes have been implemented, but managing the situation has been beyond the capacity of a single forestry department. Recognizing the urgent need to

generate public awareness of the dangers of deforestation and to encourage the general population to participate in forest management, community forestry programmes have been implemented.

Eckholm (1984a, 1984b) reports that by early 1984, 350 nurseries were operational and more than seven million seedlings had been planted with a "respectable" survival rate of 65 per cent. Achievements, however, have been localized in certain areas of the country. For example, in Surkhet District to date only 461 hectares out of 173,666 hectares of forest have been handed over by the District Forest Office to the local village panchayats as Panchayat Forest or Panchayat Protected Forest. Of this 119 hectares are in Dasarathpur, one of the four village panchayats in the study area. Afforestation targets overall have not been encouraging either. As Eckholm cautions, the total area planted or newly protected is miniscule in comparision with the country's needs. This raises serious doubts about the effectiveness of the present forest resource management programmes and calls for an assessment of the strategies being applied.

Past studies on forest resources have generally assumed firewood collection to be the principal cause of deforestation. Research has therefore focused on increasing firewood supply, on alternative renewable energy technologies (biogas, solar energy, and water power) to substitute firewood use, and on increasing the efficiency of firewood use through the introduction of improved cooking stoves (Bachman and Saubbole, 1981; Bhatta, 1982; Donovan, 1981; ERDG, 1976; Levenson, 1979; Mauch, 1974, 1975, 1977; Nakarmi and Bachman, 1982; Shakya and Joshi, 1983; Wallace, 1981).

There have also been studies on silviculture, on inventory of watershed conditions in the country, and on the institutional aspects of implementing development projects (Campbell, 1978; Hopkins, 1983; Nelson *et al.*, 1980; Pacheco, 1977; Pandey, 1977, 1982; Shah, 1980; Shrestha, Ginneken, and Sthapit, 1983). Few studies have pointed out the interconnectedness between the forest resource base, the environment, and the social organization of the Hill farmers (Berreman, 1977; Bosken *et al.*, 1977; IDS, 1981; Poffenberger, 1981; Reiger, 1977;

Reiger *et al*, 1976).

More recently studies have indicated a need to reassess the widely-held belief that firewood collection is the dominant cause of rampant deforestation in the Hill region of Nepal. Fox (1982) from his study in western Nepal concluded that the demand for livestock feed, not firewood, is the major cause of land degradation. Similarly, Wyatt-Smith (1982) in an overview of the literature on land-use pressures in Nepal concluded that the greatest demand from the forest area to supply the people's need is fodder collection, and the greatest threat to the ecosystem is undoubtedly free-grazing. Bajrachayra (1983), however, found in eastern Nepal that it is the chronic food shortage which brings about the need to clear the forest area.

While past research and management efforts have focused on increasing firewood supply, energy substitution, and efficiency in use, these more recent studies suggest that there has been an incorrect assessment of the problems involved. Moreover, Bhatta *et al.* (1977) have observed that many officers have reported about the difficulties in getting the cooperation of the villagers and convincing them of the benefits of development activities. The problem is that the current approach is directed to communicate already formulated ideas from the "expert's" side to the people. What was pointed out in 1977 as a "wrong and futile approach" (i.e. asking the cooperation of the self-reliant village people after the plans have been made without sufficiently involving them) has not changed. Consequently the implementation of the community forestry programmes (viz. the Panchayat Forest Rules and the Panchayat Protected Forest Rules) has been slow.

To provide a basis for formulating appropriate management measures there is a need for micro-level studies which assess the needs and the priorities of the village communities, because:

a. the shift of focus from firewood to fodder and food deficit as the principal causes of deforestation must be verified from other parts of the Hill region;

b. the priorities and the needs of the people tend to differ from one area to another;

c. conceptually there is a possibility for developing an interrelationship between fodder

scarcity and food deficit, i.e. the latter being the direct consequence of the former.

B. RESEARCH OBJECTIVES

Considering the research needs identified above, the objectives in this research are:

1) to verify the recent findings that fodder collection, not household energy (firewood) requirements, is the principal cause of deforesation;
2) to suggest how the community forestry programmes could be oriented to the needs and the priorities of the rural people in order to accelerate the pace of implementation.

The focus in this research is on understanding and describing the opinions and behaviour of the local people with respect to forest resource use, such that these elements can be incorporated in designing and implementing resource management programmes. In turn, this requires an assessment of the local people's perceptions of forest resource depletion and land degradation, and their attitudes and opinions towards management of the problem.

Pursuant to the objectives, this study will seek answers to the following questions based on which suggestions will be made to improve the pace of implementation of the community forestry programmes:

a. Do the Hill farmers think that there is a problem of forest resource supply?
b. What is the perception of the people regarding the causes of deforestation?
c. What are the people's opinion regarding the effectiveness of the current methods of resource use?
d. What do they believe are the effects of deforestation?
e. What are their opinions regarding ways to manage the forest resources?
f. What mix of tree species would they like to plant and where would they like to plant them?
g. What do they perceive would be the difficulties which will have to be overcome while implementing forest resource management programmes?

Specifically, the procedures applied in this research are as follows;

1) describe the patterns of forest resource appraisal and use;
2) assess local people's understanding of the relationship between the causes and the effects of deforestation;
3) assess the opinions of the local people regarding the Government's conservation and management programmes;
4) identify the local conservation and protection practices and personal efforts of the local people.

The general patterns of forest resource use in the Hill region and their effects on the environment are described in Chapter 2, to relate this study to the nature of the problem. In Chapter 3, the methodology applied in this study is presented. As a background for understanding the subsequent sections, the local conditions of the study area are described in Chapter 4. In Chapter 5 and 6 the findings of the study, i.e. the forest resource use patterns, the perceived effects of deforestation and the management measures suggested by the respondents are presented, followed by a summary and discussion. Finally in Chapter 7, the conclusions of the research are presented and, based on the findings of the study, a range of alternatives are suggested for forest resource management.

II. FOREST RESOURCE USE IN NEPAL: THE NATURE OF THE PROBLEM

A. FOREST RESOURCE USE

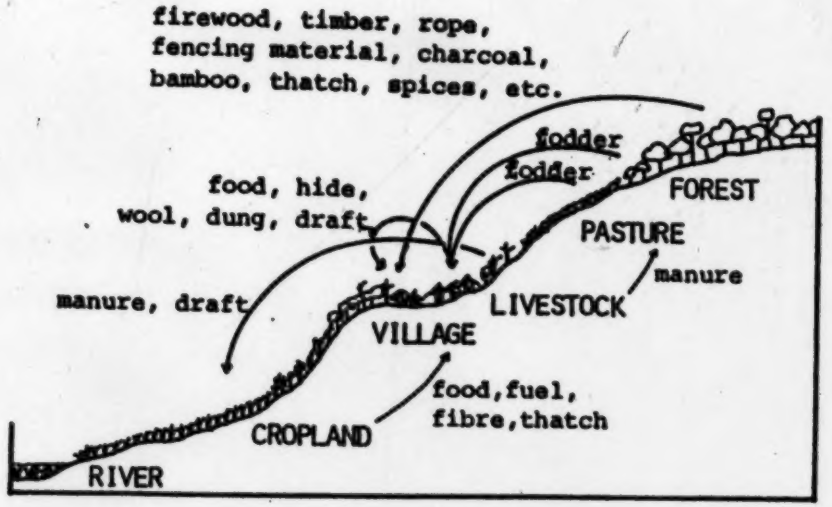
The forest is regarded by the Hill farmers in Nepal as a source of not only of firewood but many other valuable resources used for a variety of purposes. The flow of resources within a typical village environment, as illustrated in Figure 1, gives an idea of the diverse nature of villagers' dependence on the forest for their daily livelihood. The farm ecosystem is relatively self-contained and provides the majority of the needs of the farm family for food and shelter. The horizontal arrangement of the ecozones provides a wide variety of resources within a short vertical distance. An exchange of resources takes place between these zones because any one zone does not produce all the resources needed. Thus the divesity of the human resource utilization pattern parallels the natural patterns in complexity and interrelationships.

These resource demands by the Hill farmers can be classified into two categories, namely, resources extracted to meet the requirements of the people, and those for the livestock. Firewood and fodder are the two most important resources required from the forests by the villagers. The purpose of the following sequence of models is to provide an overview of the farming system (agriculture and livestock sectors) and its relationship with the local environment.

B. IMPACT OF PEOPLE ON FOREST RESOURCES

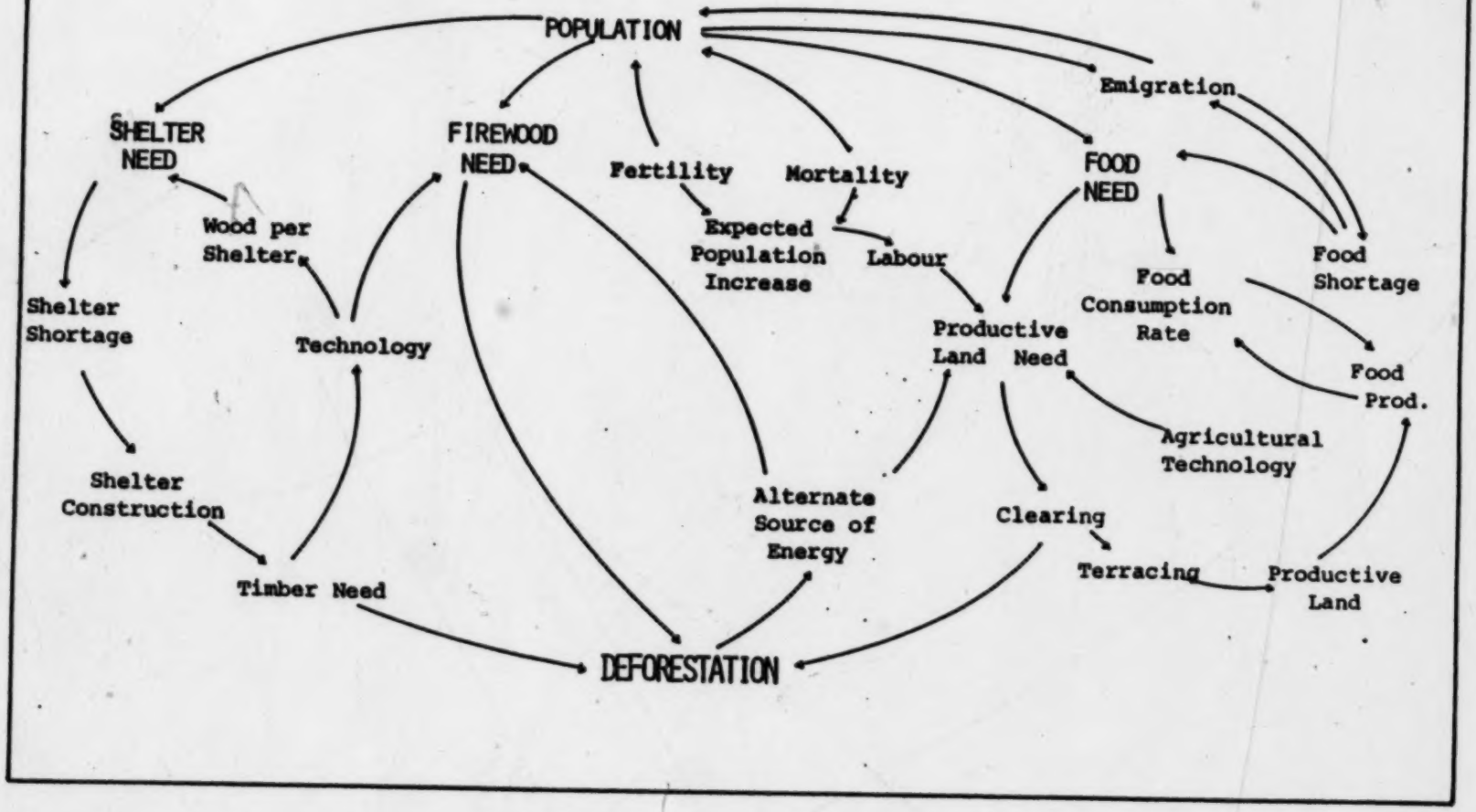
The types of demand placed by the people on the forests are shown in Figure 2. As population increases there is a need for more food, firewood to cook and keep warm, and shelter to live in. Increasing the food supply means bringing more land under cultivation either by cultivating marginal land higher up the hillside or by clearing the forest areas. Also, meeting firewood requirements for energy and timber requirements for shelter construction directly leads to deforestation. The extent of each of these pressures placed on the environment is discussed below.

Figure 1 Flow of forest resources through a typical hill village in Nepal



Based on: Levenson (1979), MacFarlane (1976), Rockefeller Team (1976)

Figure 2 Types of demand placed by people on the forest



Population and Land Ownership

During the decade between 1971 and 1981 the population of Nepal increased at the rate of 2.66 per cent per annum. According to the 1981 census the total population of Nepal was over 15 million, of whom 60 per cent lived in the Hills. [1] Banister and Thapa (1981) have projected that, since Nepal is in an early stage of its demographic transition, at least three decades of rapid population growth lie immediately ahead.

In the Hills three-fourths of the cultivable land are upland terraces (IBRD, 1981; Pant and Thapa, 1981). The average size of farm holdings is less than 1.0 hectare, often fragmented and widely dispersed at different locations. Different cropping patterns are followed to spread labour and power requirements as well as to reduce the risk of complete crop failure due to hail or untimely rainfall (ADB/HMG, 1982; Mathema and Van Der Veen, 1981). As a result the farms are too small to generate a marketable surplus. There is also a low level of output per unit of labour as an increasing amount of time is required to move agricultural inputs and tools from one plot to another, usually during the peak agricultural season when time is scarce.

Food Needs

As illustrated in Figure 2, the increase in population has meant an additional demand for food. However, agricultural production has not been able to keep pace with the rapid growth in population with the result that per capita food availability has declined steadily (ADB/HMG, 1982).

In 1965, Nepal was the fifth largest exporter of rice in the world but in recent years has become a net food importer (Blaike *et al.*, 1979). Rice yield in Nepal, which was the highest in South Asia in 1966, was one of the lowest (1.97 mt/hectare) in the region by 1982 (ADB/HMG, 1982). [2]

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[1] Geo-ecologically Nepal can be divided into three parallel regions. In the southern part of the country lies the Terai belt, an extension of the Indo-Gangetic Plain. The Middle Hills (covering 43 per cent of the total land area of Nepal) consist of high ridges and steep slopes of the Siwalik (Churia) and the Mahabharat Ranges. Along the northern boundary, roughly above the altitude of 3,000 metres, is the Himalayan Range.

[2] Similarly between 1970 and 1980, maize yields declined from 1.97 mt/hectare to 1.33

By 1976, 47 of the 55 Hill districts had a food deficit, which was an increase of 13 districts compared to 1970 (Pant and Thapa, 1981).

The food deficit has meant bringing more and more marginal land under cultivation, leading to a reduction of the overall productivity of land (Reiger, 1977). It was estimated that by 1982 the total land under cultivation had increased to 3.1 million hectares in Nepal as a whole as against 2.3 million hectares in 1975. During the same period the area under forest cover decreased from 4.8 million to 4.0 million hectares (Pant, 1983).

In many areas the forest has been almost entirely cleared up to 2000 metres elevation asl and Bishop (1976) found terraces carved into slopes of over 40 degrees. A FAO report (1974) observed that catchment areas which are only 10 per cent forested are very common throughout the country. There is very little forest area left to break or land to bring under cultivation. Furthermore, inappropriate agricultural techniques, for example in terracing and in irrigation, have led to different forms of soil erosion and the eventual loss of cultivable land. The existing level of technology and patterns of cultivation are unable to support the population adequately (Caplan, 1970).

Firewood Needs

Another effect of the population increase is the greater demand for firewood (Figure 2). It is estimated that 93.3 per cent of the domestic energy requirement in Nepal is met by firewood, the principal source of which is the natural forest. The average annual per capita firewood consumption in most Hill areas is roughly 1.2 cubic metres, which is equivalent to 780-888 kg per capita per year (Wyatt-Smith, 1982). While Donovan (1981) estimated a somewhat lower average of 1.02 cubic metres per capita per year, Levenson (1979) has estimated a 1.33 cubic metres per capita per year in another part of Nepal. [3]

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[2](cont'd)mt/hectare, millet from 1.21 mt/hectare to 0.99 mt/hectare and barley from 1.03 mt/hectare to 0.89 mt/hectare. During that decade it was only the production of wheat which showed a slight increase (from 1.00 mt/hectare to 1.12 mt/hectare (Pant and Thapa, 1981).

[3]Estimates vary considerably depending upon the weight to volume conversion factor, region of the country and the season the data were collected. Donovan (1981) has listed 49 different estimates of per capita firewood demand and Bhatta (1982) states that the estimates vary by a

Regardless of the precise figure, the extent of pressure on the forest is very significant as the supply (annual regeneration capacity) is not able to keep pace with the increasing demand.

The lack of alternatives in household energy supply has forced the villagers into total dependence on the forest, yet the natural forest has not been able to meet this increasing firewood demand. A study on the current deficit in firewood supply showed that in 47 of the 60 village panchayats surveyed, there was a firewood deficit of more than 50 per cent. Similarly in another 89 village panchayats surveyed forest growth was found to be half of the firewood consumption (cited in Wallace, 1981).

The utilization pattern of the forest has been found to be highly inefficient. Instead of cutting the forest on a rotational basis, forests closest to the villages are cut first, and cutting expands radially from that point, consequently increasing the time required to collect firewood and fodder (Bosken *et al.*, 1977; Levenson, 1979; MacFarlane, 1976). Also initially only the dry twigs and branches are gathered, but as the supply of dead wood diminishes limbs are lopped affecting the degree of regeneration of leaves in the next flush. Eventually trees are felled to provide the necessary fuel (Donovan and Bajracharya, 1980).

Timber Needs

Finally, population growth also increases the demand for timber to build houses (Figure 2). The annual demand for timber has been estimated at 0.1 cubic metres per capita (Mauch, 1974). Wyatt-Smith (1982) adds that with the population expansion and the improved quality of life expected by all, the round wood requirement can readily be increased to two cubic metres per family. In eastern Nepal, Reiger (1977) observed that about 70 cubic metres of valuable wood are logged per house, although less than 20 cubic metres could suffice, if it were properly and efficiently used.

Besides round wood, wooden shingles are used to roof a house in the higher altitudes of the Hills. Wyatt-Smith (1982) argues the serious impact of this on the forest because it takes

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[3](cont'd)factor of 60.

about 80 years to produce a tree of economic size at the elevation of 2500 metres or higher.

C. IMPACT OF LIVESTOCK ON FOREST RESOURCES

Livestock is an important component of the farming system in Nepal. The animals have the ability to ingest and transform vegetal materials into food for the people by producing fertilizer for crops, energy for traction in cultivating and threshing, and milk and meat for direct consumption (Berreman, 1977). Animals also provide cash income, wool, and are eventually a source of economic security as they can be sold in times of financial difficulty.

As a result, the stocking rate of livestock has been very high. The carrying capacity of the land is estimated to be 0.31 livestock units per hectare while the current stocking rate is nine times greater. [4] The bovine population in the Hills numbers 4.44 head per household (IBRD, 1974; IBRD, 1978). Despite the high livestock population, Nepal is a net importer of livestock at certain times of the year for religious purposes.

The relationship between the livestock sector and deforestation and that between the livestock sector and the agriculture sector is illustrated in Figure 3. Depending upon the region of the country, between 55 per cent and 75 per cent of the fodder requirement comes from forests and pastures (IBRD, 1978; Stone, 1980). About 50 per cent of the forest is grazed throughout the year. The forests and the pastures, subject to heavy pressure from freely grazing animals, get little chance for regrowth and regeneration of vegetation. The practice of burning of open grazing land further reduces the chances for natural reseeding of plants. Shah (1980) points out that ruminant livestock are in a semi-starved condition for a period of eight months per year. The productivity of livestock has declined substantially resulting in a decrease in the availability of compost, reduction in crop productivity, and subsequent abandoning of farmland.

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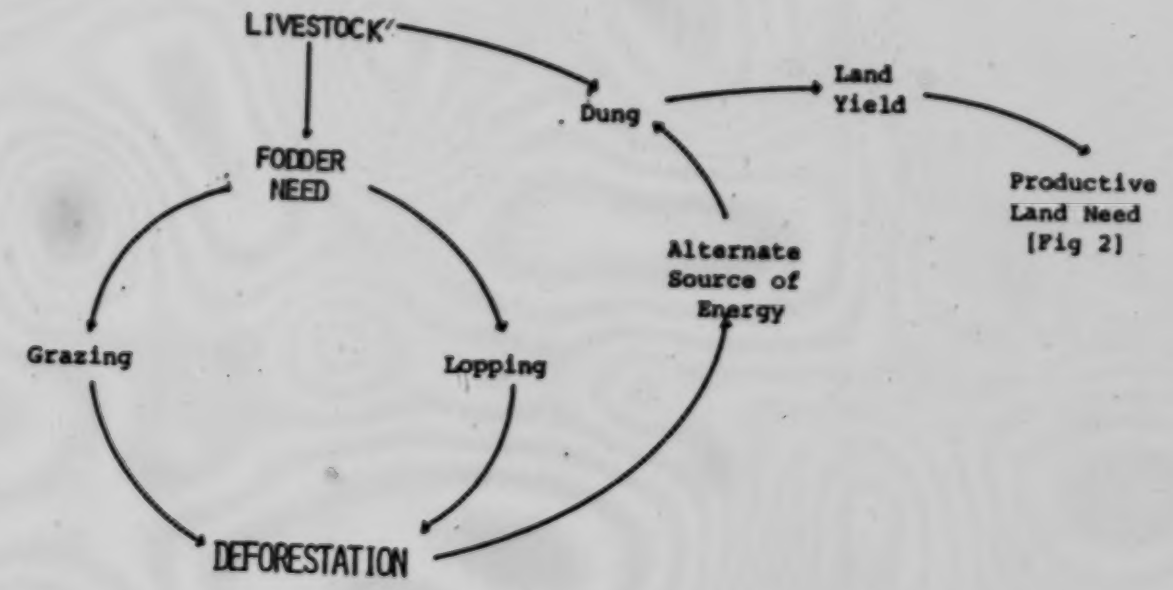
[4] Nepal's total livestock population of 12 million heads places her among those countries with the highest livestock population per unit of land area in the world (Ong, 1981; Rajbhadary and Shah, 1981).

Figure 3 Demand placed by livestock on forest



Based on: Reiger et al. (1976) and Rushdy (1981).

D. EFFECTS OF DEPLETING RESOURCES AND DEFORESTATION

The causes of deforestation described previously and their effects within the local ecosystem as well as downstream are summarized in Figure 4. All components in an environment have a system of relationship among themselves. Any change in anyone of these components has an impact and feedback on the others.

Deforestation has presumably lessened the moisture retaining and storage capacity of the soil in the Hills (McDougal, 1968). A good forest provides relatively high water infiltration rates and correspondingly low run-off of water, because of the relatively stable and porous condition of the soil and the protective layer of leaves and other organic substances (Reiger, 1983). With deforestation there is increased run-off resulting in floods, receding groundwater levels, and dried-up springs.

According to Jahn (1975) there seems to be no doubt that many springs in the Hills have reduced their flow or dried up completely in recent decades. Donner (1972) has confirmed this from many of the villages he visited, where villagers mentioned that water now has to be fetched from further than a generation ago. There has also been an increased stress in livestock watering as 30 to 40 per cent of the total demand from a village water source is for animal water needs (Johnson, 1976).

Due to the loss of top soil, agricultural productivity is not only unable to keep pace with population growth but is actually declining. Productivity further declines as the rural population burns increasing quantities of plant and animal waste instead of recycling them as compost. Population growth in the context of a traditional agrarian technology is forcing the farmers onto ever steeper slopes, these being unfit for sustained farming (Eckholm, 1975, 1976). This accentuates the problems of run-off, erosion, and mass-wasting. [5]

The increasing pressure of population upon the difficult and unproductive Hill environment has also led to both seasonal and permanent migration (Bista, 1977; Gurung,

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[5]Laban (1979) found that landslide density ranged from 0.2 per kilometre on stable land under undisturbed conditions to 2.8 per kilometre on very susceptible lands fully exposed to man's influence.

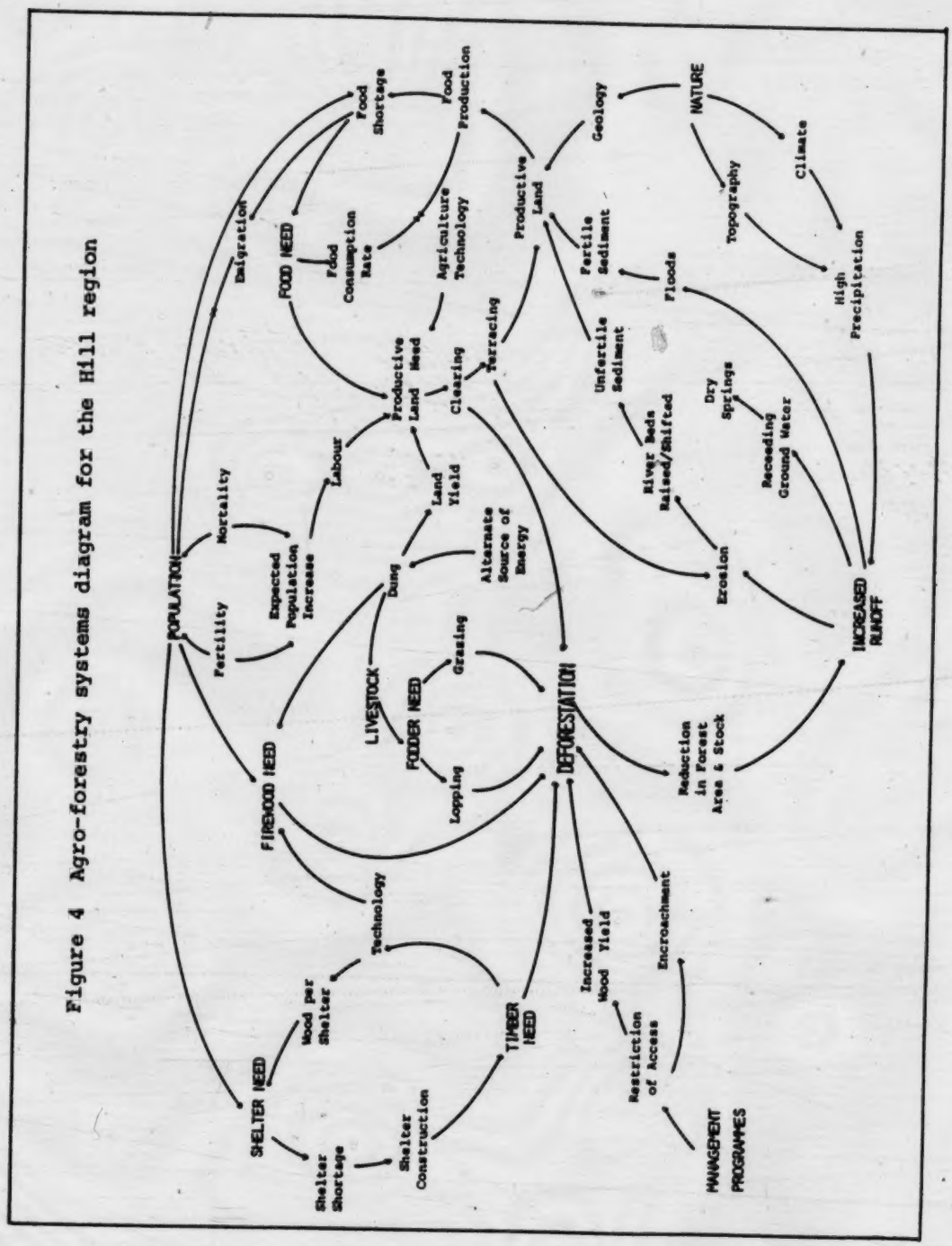

Figure 4 Agro-forestry systems diagram for the Hill region

1979; Hitchock, 1961; Poffenberger, 1981; Rai *et al.*, 1977). [6] This may have served some useful purpose in relieving the pressure on the Hill environment. However the process only shifts the pressure to another location (the Terai) (Rana and Thapa, 1975; Schmidt, 1976). [7] Migration leaves a bi-modal distribution of population of the young and the old at home. Thus the Hill region is drained of its active population and leadership. Agricultural pursuits are left unattended and cottage industries are depressed (Anon, 1983).

Downstream effects are also symptoms of the deforestation problem within a catchment area. It is estimated that 240 million cubic metres of soil are eroded away from Nepal every year (IBRD, 1974).[8] Deposition of sand and silt is consequently raising the river beds in the Terai by nearly 16 centimetres annually resulting in annual flooding and considerable shifts in the course of rivers (HMG, 1974). [9] However, it is also true that without such a natural weathering process there would be no fertile valleys and plains.

The process of land degradation is further accentuated by the natural features of the country. The topography varies from the nearly sea-level tropical jungles to the frozen glaciers of the highest chain of mountains in the world. The mountains formed during the Tertiary Period are young and geologically still unstable. These mountains also form a terminal barrier to the seasonal monsoons of the Indian subcontinent. Where steep topography is combined with heavy rainfall, surface erosion will be natural and cannot be avoided. The problem is that this natural phenomenon (the influence of elevation, slope, gravity and climate) has been

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[6] In the space of 30 years the volume of migration has almost tripled. In 1951, 3.5 per cent of the Hill population left their homes and settled down temporarily or permanently away from home. In 1961 this rose to 5.95 and in 1971 it reached 9.0 per cent (Toffin, 1976).

[7] Of the estimated 400,000 migrants from the Hills in the decade of 1965-1975, only eight per cent were settled by the Nepalese Government. This resettlement occured on just 9000 hectares of cleared forest land, whereas the balance settled spontaneously, without Government approval, on 120,000 hectares of forest land (IBRD, 1978; Sainju and K.C., 1981).

[8] The final deposition of the silt load takes place in the Bay of Bengal where in 1974 an Earth Resource Technology Satellite spotted an immense new island just surfacing. It turned out to consist of 116,000 square kilometres of Himalayan silt (Sterling, 1976).

[9] The Kosi River has shifted its course 125 kilometres westwards within 250 years leaving 150,000 square kilometres of once fertile land buried under a mass of sand and rubble and displacing 6.5 million people in Bihar (Sharma, 1977; Zollinger, 1974; Zollinger, 1979). Likewise in the Kosi Barrage the reservoir is so choked with silt that birds flock there to wade in the marshy swampland (Sterling, 1976).

vastly accelerated with the interference by man.

E. RESOURCE CONSERVATION PROGRAMME

Past Legislation

Traditionally various communities in Nepal had different social systems for controlling the use of forest resources. Regmi (1976) writes about the *Kipat* land tenure system under which individual villages laid claim to various forested areas for their exclusive use and management. According to Caplan (1970) many villages in Nepal had systems in which forest and pasture lands were considered community property that could be used by non-community members through payment of fees or other commodities. MacFarlane (1976) found this system still being practised by the Gurung communities in western Nepal.

Likewise, many villages had a communal system of gathering and harvesting of forest resources which ensured an equal distribution of products. The Sherpas in Khumbu even had a strict rationing system to control the use of firewood and lumber since trees regenerated so slowly in the high-altitude ecosystem (Hagen, 1971; Heimendorf, 1975). The tradition of temple and monastery forests ensured that the trees growing near these religious structures were not cut (Campbell, 1978). Hitchock (1977) summarizes these as locally acceptable adaptive strategies which provided the necessary goods and services. They operated in approximate balance with the productive potentials of the environment. The study of these adaptive strategies will provide valuable information in land-use practices since the introduction of "modern" technologies in the Hills has not been overly successful.

With the increasing population, the pressure on the forest to maintain the supply of the resources also increased. Realizing the consequences of the extensive deforestation which began to take place, His Majesty's Government of Nepal enacted various legal instruments. The first such effort was the enactment of the Private Forest (Nationalization) Act in 1957 to preserve the forests and to ensure a sustained yield for the villagers. The Forest Act (1961) laid grounds

for further solidification of the Government's claim over the forests nationalized in 1957.

The nationalization of the forests has had an adverse effect on the motivation of the local people to conserve their own resources because the ownership as well as the management of the forests became the responsibility of the Government (Campbell, 1978; FAO/IBRD, 1979; Levenson, 1979; Manandhar, 1980). The effect was that the villagers ceased to apply the traditional rules for forest management and community responsibility for forest protection. Consequently the process of deforestation accelerated.

In the past the Government had placed priority on promoting the export of timber from the Terai to increase state revenue. The Ministry of Forests was set up in 1942 with the objective of exporting the timber. It is only during the recent decade that the Ministry has also focused its attention on the management of the Hill forests. The Department of Soil and Water Conservation was set up in 1974 and recently upgraded to the Ministry level, indicating the Government's recognition of the seriousness of the land degradation problem in the country (Fearnside, Nelson and Baisyet, 1980). Also in July 1982 the Government officially banned both timber export and the resettlement programmes in the Terai.

Community Forestry Programme

Realizing the ineffectiveness of the Forest Act (1961), the Nepalese Government promulgated "radically new rules to create community forests ... with the objective of returning ownership of the resources to the people" (Manandhar, 1980). The main objective of the Panchayat Forest Rules (1978) and the Panchayat Protected Forest Rules (1978) is to encourage forestry management on a communal arrangement basis by releasing land for afforestation or giving rights on existing forests to the village communities as:

a. Panchayat Forest where the ownership, management and protection is vested in the village panchayat. Each village panchayat is eligible for 125 hectares of forest land for the creation of Panchayat Forest.

b. Panchayat Protected Forest, i.e. any forest land which needs protection and/or some

enrichment planting. Each village panchayat is eligible for 500 hectares of forest land for Panchayat Protected Forest. Forty per cent of the revenue (net income of royalties from felling) is to be paid into the village panchayat funds and the rest goes to the central government.

There is also a provision for leasing, with nominal rent, the areas consisting of treeless government land, to individuals or organizations for the production of timber, firewood, fodder grass or other forest products. Another category is the private forest which are woodlots set up on private property. Among these four categories of forests the first two are the prominent ones.

Based on these legislations, community forestry programmes were introduced in 55 Hill districts through the implementation of the forestry components of various integrated rural development projects and through the Community Forestry Development Project.

The general objectives of the forestry components of these projects are (FAO/IBRD, 1979; Manandhar, 1980):

a. to increase the supply of firewood,

b. to produce leaf fodder and grass,

c. to produce timber,

d. to introduce and popularize improved cooking stoves to conserve firewood.

The need for local acceptability of the tree species has been recognized in current reforestation programmes and silvicultural research is focusing on the search for multi-purpose, fast growing species preferred by the villagers. Contrary to the local people's preference for fruit, broad leaf fodder, and firewood species, past reforestation efforts had stressed single species like pine and eucalyptus.

The forestry officials had always seen their role as "forest policemen" and had tried to stop the people from what they had been doing. No consideration was given to the immediate energy requirements of the people and no acceptable alternatives were offered. This had resulted in antagonism, deep mistrust, and cynicism about the Government officials in general.

The time-consuming process of changing the attitude of both the local people and the foresters has been initiated with the implementation of the community forestry programmes. Now, the role of the foresters is seen to be that of an extension agent - a source of information, expertise and technical assistance for the individual farmers and the communities.

Due to socio-cultural reasons, efforts to promote smokeless, efficient cooking stoves have not been very succesful. For example, as these improved stoves are built precisely to contain heat rather than emit it, their fuel-saving properties result in conflict with social values not related to fuel efficiency.

A number of alternative energy sources are available for the Hills, namely biogas, water, wind and solar energy. Cost, adequate supply of dung, and temperature restriction in the higher altitudes for the fermentation process have restricted the adoption of biogas plants. Financial constraints, lack of maintenance arrangements, and lack of demand are problems associated with water power development at the village level. The technology regarding the use of solar and wind energy is still at its infancy stage in Nepal. Finally, the IBRD (1984) report emphasizes long range strategies to supply firewood because comparisions based on end-use efficiency indicate that for meeting household cooking and heating needs, fuelwood from the planned forestry programme is much cheaper than electricity or kerosene.

Progress in implementing forestry programmes has been slow due to the inherent problem of institutional management within the implementing jurisdictions. Shrestha and Apedaile (1982) have documented a number of reasons such as lack of trained staff and administrative personnel, staff turnover and absenteeism, delays in funds disbursement, lack of coordination between departments, and so on. [10] Similarly coordination between different international donors and agencies is difficult. [11] These are, of course, prerequisites for successful programme implementation.

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[10]For example, Fearnside, Nelson and Baisyet (1980) list 14 ministries and central level agencies among whom coordination is required to implement soil and water conservation projects.

[11]There are 15 bilateral and 15 multi-lateral donor agencies and a host of non-governmental organizations working in Nepal. The 30 agencies alone have over 260 advisors and 269 volunteers. Twelve of the agencies have major forestry and livestock development projects (Shrestha, 1984).

Despite the current efforts, due to various reasons there has been a consistent shortfall in the implementation of the forestry programmes. The afforestation target of 20,000 hectares during the Fifth Plan (1975-1980) was not achieved and only 9864 hectares could be afforested. During the first three years of the current Sixth Plan (1980-1985) only 37 per cent of the targeted afforestation goals were achieved. The survival rate of the seedlings in the reforested areas has been between 38 to 65 per cent (Campbell and Bhattarai, 1983).

Therefore, as identified in the previous chapter, there is an urgent need to search for appropriate measures to accelerate the forest management programmes if the consequences of deforestation being experienced by the Hill farmers described in this chapter are to be averted.

III. DESIGN AND ADMINISTRATION OF THE STUDY

A. SELECTION OF THE STUDY AREA

The field work for the research was conducted in the Surkhet District in mid-western Nepal. The District is one of the areas in Nepal where the pace of implementation of the community forestry programmes has been virtually negligible, yet the area is within the geo-ecological zone where deforestation and land degradation have been most pronounced. Among the 75 districts in Nepal, the watershed condition in the Surkhet District is considered to be the most degraded (HMG, 1977; Shrestha, Ginneken, Sthapit, 1983). The study area is described in more detail in Chapter Four.

The Surkhet District is part of the area where the Canadian International Development Agency (CIDA), the funding agency for this research, is cooperating with His Majesty's Government of Nepal in implementing an integrated rural development programme. The project area is comprised of a number of districts, but as Surkhet is accessible by air throughout the year, it was logistically more suitable than other districts for the research. The availability, from the project, of certain relevant data regarding the study area was another reason for selecting the Surkhet District.

B. SAMPLING

A three-stage sampling design was followed to identify the sample population. In the first stage four sample village panchayats were identified. [12] In the second stage two wards were selected from each sample village panchayat. Finally, in the third stage, the total number of households to be interviewed was calculated and the households were randomly selected from each ward proportionately.

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[12]A village panchayat is a political/administrative unit consisting of several villages with a total population of 2000-4000 persons. For administrative purposes, each village panchayat is divided into nine wards. A varying number of village panchayats make up an administrative district.

Selection of the Village Panchayats

Given the nature of the research project, certain *a priori* criteria had to be specified for the selection of the village panchayats. The following criteria were applied:

a. the sample village panchayat must be located in the midland (Hill) region where deforestation and land degradation have been most pronounced;

b. a varying state of deforestation, land degradation and pressure on resources should be present to assess variations in the attitudes and perceptions of the people in relation to resources availability.

Utilizing the knowledge of the local elected officials and the officers from the District Forest and the Soil and Water Conservation offices, four village panchayats were selected in the Surkhet District in which to conduct the field work (Figure 5). Two of them, namely Dasarathpur and Satakhani village panchayats in the eastern part of Surkhet were selected to represent the area with an extended state of deforestation. Babiyachaur and Kunathari village panchayats were selected to represent the area with a still good forest cover. These latter village panchayats are located in the western part of the Surkhet District.

Selection of Wards

Information regarding the forest area, the population and the number of livestock in each ward for each of the above mentioned village panchayats was available from the "Village Profiles" prepared by the Karnali-Bheri Integrated Rural Development Project (K-BIRD). First the livestock numbers were converted to livestock units in order to aggregate the different kinds of animals. [13] Then for each selected ward of each sample village panchayat, ratios between population and forest area and that between livestock units and forest area were calculated. These calculations were made for all village panchayats. As an example, those for Kunathari are shown in Table 1.

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[13] In converting the different kinds of animals into livestock units, the following factors were applied: 1 buffalo=1.5 livestock unit (LSU), 1 cow=1.0 LSU, and 1 goat=0.2 LSU.

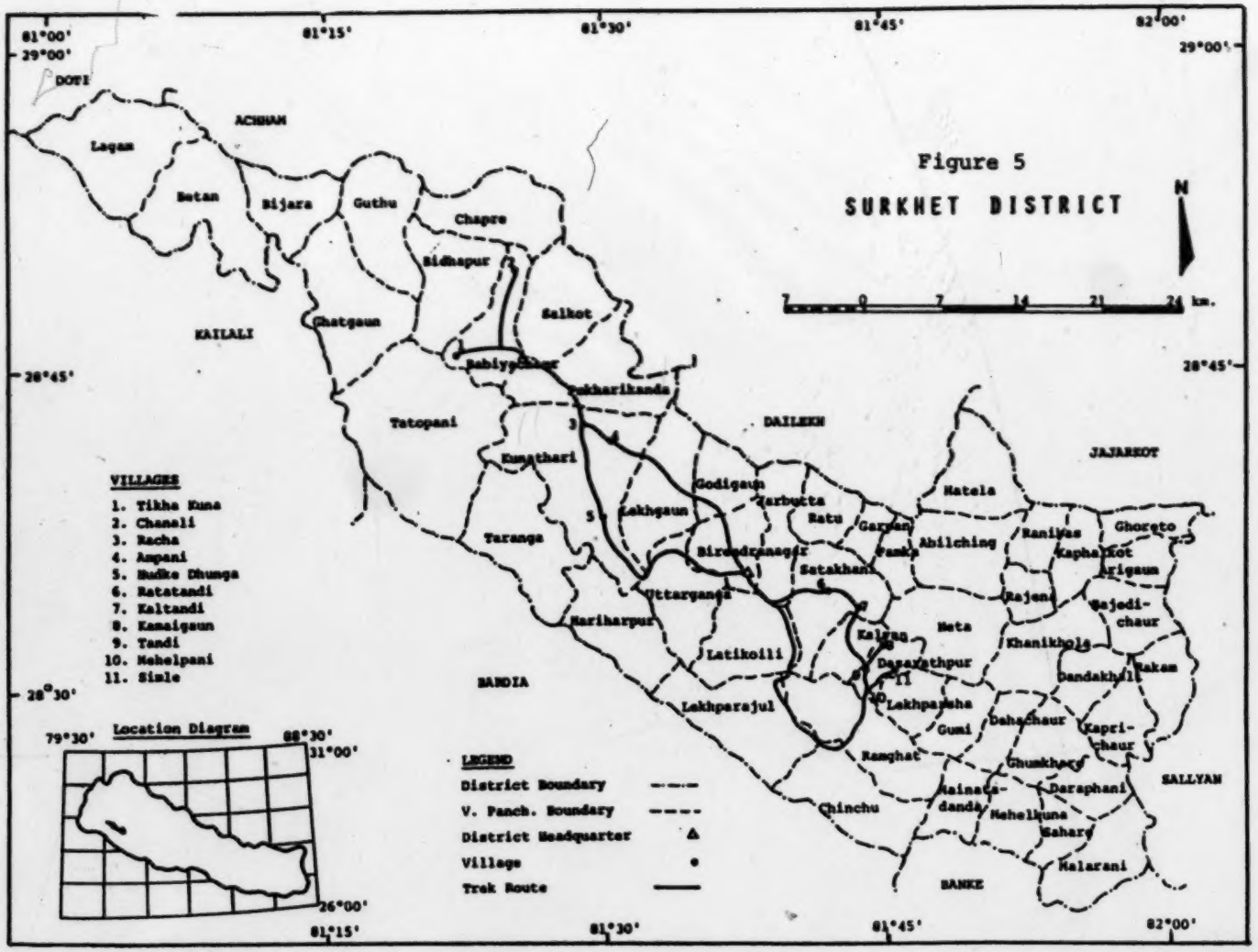


Figure 5
SURKHET DISTRICT
N
0 7 14 21 24 km.
81°00'
81°15'
81°30'
81°45'
82°00'
29°00'
28°45'
28°30'
DOTI
ACHHAM
Lekam
Batan
Bijara
Guthu
Chapre
Sidhapur
Salkot
Ghatgaun
KAILALI
Tatopani
Kumathari
Tarange
Pakharikanda
DAILEKH
JAJARKOT
Godigaun
Tarbutta
Ratu
Lakhgaun
Garjan
Panta
Abilching
Hatela
Raniwas
Ghoreto
Kapha
Kot
Rigaun
Satakhani
Rajeni
Bajedi-
chaur
Uttarganga
Hariharpur
Latikoili
BANDIA
Kalagaa
Meta
Khanikhola
Dandakhil
Bakam
Lakhparajul
Lakhpasha
Gumi
Dahachaur
Kapri-
chaur
Ranghat
Ghumkharka
SALLYAN
Chinchu
Mainata-
danda
Mehelkuna
Daraphani
Kahara
Malarani
BANKE
VILLAGES
1. Tikha Kuna
2. Chanali
3. Racha
4. Ampani
5. Budke Dhunga
6. Ratatandi
7. Kaltandi
8. Kanaigaun
9. Tandi
10. Mehelpani
11. Simle
Location Diagram
79°30'
80°30'
31°00'
26°00'
LEGEND
District Boundary
V. Panch. Boundary
District Headquarter
Village
Trek Route

TABLE 1

CALCULATION OF POPULATION/FOREST AREA RATIO AND
LIVESTOCK UNIT/FOREST AREA RATIO FOR
KUNATHARI VILLAGE PANCHAYAT

Ward	Forest Area[1]	Population	LSU[2]	Ratio of Population to Forest Area	Ratio of LSU to Forest Area
1	250	850	520	3.4	2.08
2	280	400	287	1.43	1.03
3	200	280	194	1.4	0.97
4	100	600	703	6.0	7.03
5	n.a.[3]	232	n.a.[3]	-	-
6	60	500	310	8.33	5.17
7	75	380	343	5.07	4.57
8	60	200	280	3.33	4.67
9	50	525	638	10.5	12.76

1. Forest area in Bighas [1 Bigha = 0.68 hectares]
2. Livestock Stocking Unit
3. Data not available

Source: K-BIRD (1982)

After the two ratios (i.e. population/forest area and livestock unit/forest area) were calculated, two wards, one representing the highest density and another representing the lowest density, were selected from each of the four sample village panchayats to conduct the interviews.

Selection of Households

It was decided that a total of 100 sample households from the eight sample wards of the four village panchayats would be interviewed. Given the necessity for a sufficiently large sample for statistical analysis and the constraints imposed by time, funds, and accessibility a decision was made to interview 100 households. The 100 interviews were then allocated to wards proportionally to the population size of each ward (Table 2).

When the interviewers went to a sample ward, the first *N* households (i.e. the predetermined number of households to be interviewed in that ward) available or agreeing to be interviewed, were interviewed. As the timing of the interviewing coincided with the cropping season, interviewees were not always available or were busy with their work in the fields. Therefore, another household had to be approached. On only two occasions did householders refuse to be interviewed.

C. QUESTIONNAIRE

Structure of the Questionnaire

A structured interview questionnaire in Nepali was used for the interviews. An English translation of the questionnaire is presented in Appendix I. The questionnaire consisted of both closed and open-ended questions. Contingency questions, probing for reasons for certain responses, were generally open-ended questions.

The questionnaire contained four main sections:

a. information about livestock numbers and fodder collection;

TABLE 2

HOUSEHOLD DISTRIBUTION IN SAMPLE VILLAGE PANCHAYATS

Ward	State of Deforestation/Village Panchayats								Total	
	HIGH				LOW					
Ratio of forest area to population and livestock stocking	Dasarathpur		Satakhani		Babiyachaur		Kunathari			
	hhs	n	hhs	n	hhs	n	hhs	n	hhs	n
HIGH	45	10	99	21	56	12	38	8	238	51
LOW	33	7	80	17	66	14	52	11	231	49
Total	78	17	179	38	122	26	90	19	469	100

hhs: Total number of households in the ward.

n : Sample.

b. information on firewood collection;

c. information on attitudes towards resource use and conservation;

d. personal attributes.

Information on livestock included questions regarding the number of cattle, buffalo, goats and sheep per household. Regarding fodder collection questions were asked about the number of loads of fodder required per day, from where it is collected and how long it takes, and where the livestock is grazed. A final question in this section concerned whether any livestock is stall-fed and the reasons for stall feeding.

Questions on amount, source and time required for firewood collection were asked, as well as what other sources of energy are used besides firewood (if any), and whether any firewood is purchased. Questions were asked also about the change in the time required for firewood and fodder collection over the previous five years. Other questions were asked to determine whether the forest area in the village panchayat has decreased or increased over that period and the reasons for the change.

The next section of the questionnaire began with questions on the perceived effects and the causes of deforestation. Another set of questions were on whether there are any specific forest conservation practices in the village and whether there has been any community and/or personal initiative to plant trees. This section concluded with an examination of people's awareness of the Government's forest management programmes.

The final section on personal attributes collected information on the respondent's ethnic background, land ownership and the number of people in the household according to age groups.

Pretest of the Questionnaire

A pretest of the questionnaire was conducted in Neware village outside Birendranager, the district headquarters of the Surkhet District. Fifteen randomly selected households were interviewed by five research assistants. The principal researcher participated in at least one

complete interview with each of the assistants. Later the team met to discuss their performance and to go through the questionnaire to review problems encountered. Two research assistants, because of their lack of understanding of the village situation and terminology, were replaced by local people.

The questionnaire was revised in terms of sequence of the questions, wording and translation, and in the answer categories of the closed questions. Based on the responses from the pretest, answer categories were developed for most formerly open ended questions.

D. ADMINISTRATION

During the pretesting it was found that the majority of the farmers approached were not available during the day, as they were preparing their fields for rice planting and maize cropping. As it was anticipated that the situation would only get worse once the rains began, interview schedules had to be revised to complete all the interviews within the two subsequent weeks. The interviews were administered during the early mornings and late evenings when farmers were more likely to be at home.

During the interviews, an attempt was made to have both the male and female heads of households present because answers to some parts of the questionnaire were more familiar to one than the other. Male farmers consistently referred questions about resource use and practices to the women of the household, indicating a higher level of involvement of women than men in forest resource collection and use.

E. DATA ANALYSIS AND INTERPRETATION

After the interviews were completed, summary data sheets were prepared for each of the questions for all 100 respondents, and a coding manual was prepared for the entire questionnaire. Using this format the data were then transferred to coding sheets and later punched on cards.

The SPSS statistical package was used for the data analysis. The first set of computer outputs consisted of raw frequencies. The data were then "cleaned", and adjusted frequencies for all variables were computed. For certain variables (e.g. livestock ownership, land ownership), the mean, median and mode were calculated. Assessment of between-variable relationships was carried out largely by means of crosstabluation. For this purpose ratio measures such as land ownership, livestock units and household size were defined as ordinal variables.

As there was a small number of observations in many of the wards, some method had to be found to collapse the data in order to permit statistical analysis. Two main possibilities were explored, namely classification based on:

a. the level of land use pressure, i.e. ratio between forest area and population and livestock number;

b. the proximity of village panchayats based on perceived state of deforestation, i.e. classification of Dasarathpur and Satakhani together to represent an overall group of "high deforestation" while classifying Babiyachaur and Kunathari together to represent a "low deforestation" village panchayats.

Upon the examination of variations in pertinent variables, it was decided that the latter classification was most appropriate because,

a. the classification of data based on proximate village panchayats was considered to provide more meaningful results about the nature of the deforestation problem than according to an artificially devised measure of land use pressure;

b. for management implications, data on existing politico-administrative units is easier to relate to than vague unfamiliar units.

IV. THE STUDY AREA

A. INTRODUCTION

The Surkhet District being located in the mid-western Hill region of Nepal where deforestation has been most pronounced was one of the justifications for selecting it for the field work. The study was conducted in four village panchayats in the District. Dasarathpur and Satakhani village panchayats, in the eastern part of the Surkhet District, settled earlier than in Babiyachaur and Kunathari by the people from the surrounding hills, have experienced a greater amount of forest clearing than in the latter two village panchayats. Much of the forest has been cleared for farming and to meet firewood and fodder requirements.

Babiyachaur and Kunathari village panchayats are composed of extensive undulating terrain, still relatively rich in vegetation and wildlife. However, while walking along the trail through the forest, one can see herds of livestock grazing and also continually hear the woodcutters' axes chopping away. Even the fields are littered with stumps of trees and logs indicating the recent clearing of the forests. Therefore, although these two village panchayats were described to be in the state of low deforestation, this characterization is relative rather than absolute, and the process of deforestation is already progressing. It is apparent that what has already happened in Dasarathpur and Satakhani village panchayats is also happening rapidly in Babiyachaur and Kunathari.

B. GEOGRAPHICAL SITUATION

The four village panchayats surveyed are located in the Siwalik foothills of the Himalayan Range with elevations ranging from 300 metres to 1000 metres.

The geological materials in the study area are sandstone and siltstone of the Siwalik tertiary sediments. The surface is very unstable and sensitive to soil erosion. Deforestation and careless agricultural practices in this region, without sensitive management, will easily result in erosion.

In general, the climate in the study area is humid subtropical. Air temperature is influenced by elevation and the nature of the slope. The rainfall pattern is of the monsoonal type with a marked dry season. The mean annual precipitation is between 1300 and 2000 mm. About 82 per cent of the total rain occurs between June and September. The intensity of rain is very high during the summer months. Winter rains are unpredictable and unreliable. According to Koppen's classification, this is a subtropical monsoon climate, with maximum temperatures occurring before the rainy season (Cwag). Given in Table 3 are the average monthly rainfall, temperature and relative humidity for Birendranagar (Figure 5), the meteorological station closest to the study area.

There are stands of mature forests (designated Fm/*Fm in Figure 6) in Kunathari, Satakhani and Dasarathpur village panchayats. Dominant tree species include sal (*Shorea robusta*) and chir pine (*Pinus roxburghii*) (Stainton, 1972). Harvesting of timber in this area requires extreme caution because the forest is growing on Siwalik tertiary sediments. Similarly harvesting in the undifferentiated (*Fu) forest also needs to be done with caution.

Stands of immature forest (*Fi), predominantly of pole-size trees, have the future potential for extraction of fodder under sensitive management. Currently there is a need for protection (from fire, fodder/firewood removal, thinning, etc.) to allow the trees to grow to maturity. Located particularly in the northern part of Satakhani village panchayat are areas of degraded forest (Fppf) and overgrazed pastures (Fpf) in need of immediate management attention.

Land use in the study area is mostly rainfed agriculture. Cultivation is generally on the northern slopes and ridge tops. Besides the area identified as cultivated land (A), in Figure 6, all forest and shrub land units include small pockets of cultivated land.

TABLE 3

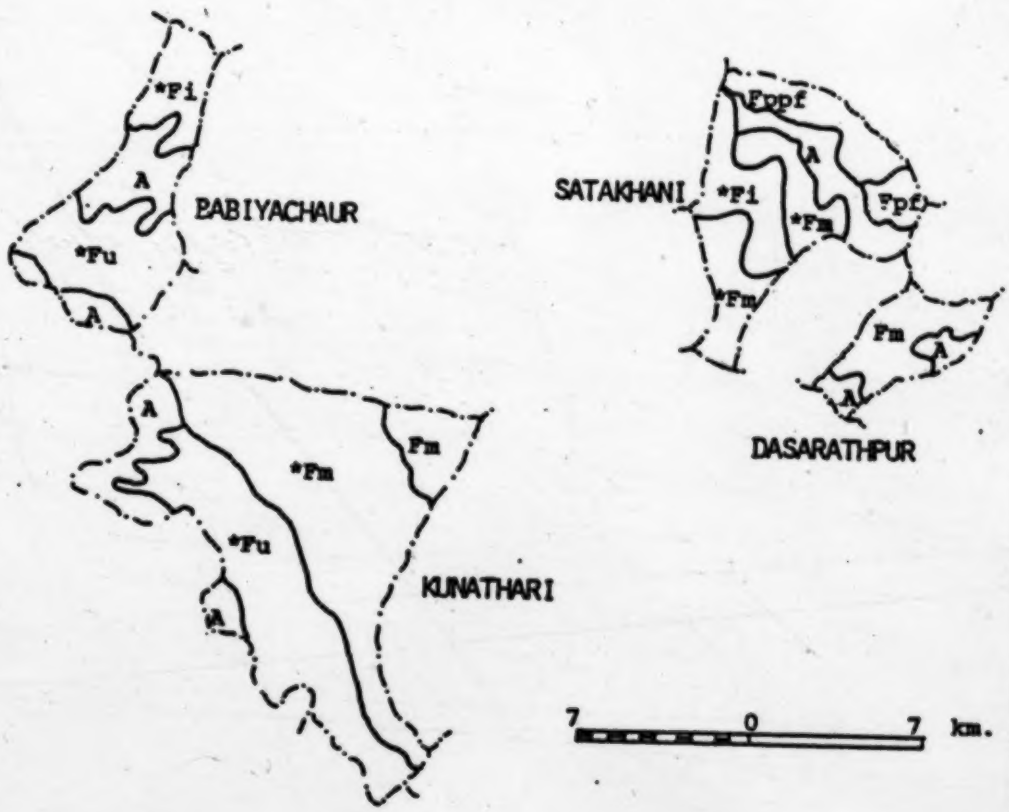
AVERAGE MONTHLY RAINFALL, TEMPERATURE AND RELATIVE HUMIDITY

BIRENDRANAGAR, SURKHET

Months	Rainfall (mm)	Temperature mean max °C	Temperature mean Min °C	Relative Humidity
January	13.4	19.7	4.2	93.8
February	31.2	20.8	6.9	88.2
March	41.2	27.2	11.8	65.4
April	32.6	32.7	16.0	47.2
May	85.2	34.2	19.8	48.8
June	200.8	32.6	22.4	27.0
July	429.2	30.1	22.9	88.6
August	379.8	30.3	22.7	89.6
September	148.0	29.6	20.5	87.6
October	23.4	22.1	15.6	83.4
November	22.0	25.1	9.9	86.0
December	22.6	20.7	5.7	94.4

Source: Department of Irrigation, Hydrology and Meteorology (1976-1980)

Figure 6 Present land use in the study area



A	Cultivated land
Fpf	Shrub and overgrazed
Fppf	Degraded forest
Fi/*Fi	Immature or regenerating forest
Fm/*Fm	Mature forest
Fu/*Fu	Undifferentiated forest

* Areas with higher sensitivity because of greater instability of rock type.

N.B. All forest and shrub land units include small pockets of low-intensity cultivated land.

Source: "Surkhet District Land Management Plan", HMG/Kenting.

C. POPULATION

The total population of the eight wards in the four village panchayats surveyed was 3808. In the sample of 100 households surveyed from these eight wards, the total population was 683. The precise annual rate of increase in population in the study area is not known. However, between 1971 and 1981 the actual average annual increase in population in the Surkhet District was 4.14 per cent compared to the national average population growth of 2.66 per cent per annum and 1.01 per cent in the Hills of the mid and far-western region of Nepal during the same period.

The in-migration from the northern districts of the mid-western region, particularly from the districts in the Karnali Zone, where food production has become progressively inadequate over the years, could account for this high rate of population growth in the area. With the eradication of malaria in the last 20 years, the forces of migration have resulted in further population growth. Furthermore, Birendranagar being named the headquarter for the mid-western region has attracted settlement from the neighbouring Hill districts. In the past the Surkhet District had only been a transitory point for the people from the north seeking temporary winter/spring employment or for those going to the market area in the Terai to sell cottage industry products and purchase consumer goods.

Among the sample, the average household size was 6.83 persons (Table 4). The table also shows that only in the Babiyachaur sub-sample was the average household size smaller than this sample average. The larger households together with the high population growth rate would mean that more agricultural land and firewood are required to sustain the growing demand for forest resources. The efforts to increase the cultivated land by encroachment is evident from recent clearing and the numerous pockets of cultivated land seen in the forest areas.

Furthermore, 31.3 per cent of the population are under the age of 10; within a few years these children will be reaching the fertility age. Also, the continuing pull effect of the area on the migrants will keep the population growth rate very high. Consequently the

TABLE 4

NUMBER OF HOUSEHOLDS, POPULATION AND HOUSEHOLD SIZE

Village Panchayat	Number of Households	Population	Average Household Size
Dasarathpur	17	119	7.0
Satakhani	38	270	7.1
Babiyachaur	26	157	6.0
Kunathari	19	137	7.2
Total/Average	100	683	6.83

land-man ratio will increase and in the absence of immediate and effective management, the pressure on resource utilization is bound to increase rapidly.

D. LAND OWNERSHIP

The amount of land owned, which indicates the socio-economic level of the households in the rural areas, has been used as a basis for focusing development efforts at particular sections of the society. Therefore for the purpose of the analysis of the survey data, land ownership has been categorized into farm-size groups. Those farmers owning zero to 0.75 hectares, 0.76 to 1.25 hectares and more than 1.25 hectares, were classified as small, middle and large farmers respectively. Of the 100 households in the surveyed panchayats, 40 were small farmers, including three who were landless (Table 5); 34 households were classified as middle farmers, and the remaining 26 as large farmers .

The average land holding in the sample was 0.96 hectare per household. [14] This is lower than the average land holding of 1.25 hectares per household in the Hill region (Fleming, 1978; Stone, 1980; Wyatt-Smith, 1982). In the study area it was found that one hectare of cultivated land supports 7.1 persons. Ninety-six of the one hundred households interviewed were found to be totally dependent on their farms for subsistence.

Given the high average household size and the population growth rate, the food balance situation in the study area is bound to deteriorate further. The rule of succession/inheritance will further fragment the land into increasingly smaller parcels. The only method the farmers use to replenish the soil nutrients, that is the application of livestock waste compost, has been declining with the contraction of the fodder base, thus negatively affecting the agricultural productivity of the farmland.

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[14] Agricultural land ownership can be classified into three types with most households holding land in various combinations. In the study area 82 per cent of the households had *khet* (irrigated land) with an average holding of 0.39 hectares (range 0.06 to 1.53 hectares). Ninety-two per cent of the households owned *pakho* or *gharbari* (land not irrigated) with an average holding of 0.53 hectares (range 0.1 to 2.04 hectares). Finally, 17 per cent of the households owned *kharbari* (pasture, source of thatch) with an average holding of 0.06 hectares (range 0.04 to 2.04 hectares).

TABLE 5

LAND OWNERSHIP IN THE SAMPLE VILLAGE PANCHAYATS

Land Area (Hectares)	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
0.00 - 0.75 [Small farmer]	7	41.2	12	31.6	14	53.8	7	36.8	40
0.76 - 1.25 [Middle farmer]	8	47.0	8	21.0	10	38.3	8	42.1	34
More than 1.25 [Large farmer]	2	11.8	18	47.4	2	7.7	2	21.1	26
Total	17	100	38	100	26	100	19	100	100
Average land ownership per household	0.9		1.2		0.7		0.8		0.96

Source: Survey findings.

E. LIVESTOCK OWNERSHIP

Each household in the sample had at least two head of animals. Table 6 shows that the average number of animals in the study area was 8.4 head per household. [15] In Babiyachaur and Kunathari, the average number of animals per household was more than in Dasarathpur and Satakhani. Table 6 also shows that there are an average of 9.6 LSU per household. Livestock ownership was highest in Kunathari village panchayat, at 13.7 LSU.

The livestock density in the study area is estimated to be over 10 times the carrying capacity of the land in the Hill region in general. Besides the livestock number in the area itself, there is a further increase in their numbers during the winter season when herds are brought to the area from the northern parts of the region. Such high stocking rates are bound to further deteriorate the pastures, the forest and the other sources of livestock fodder.

In the study area, small farmers had fewer animals per household (6.1 head) than middle (10.3 head per household) and large farmers (9.2 head per household). However, as farm land is a very important source of fodder (both green and crop residue), and given the small area of land the small farmers own, they are more dependent on public land than the middle and large farmers, who can meet more of the livestock fodder requirements from private sources.

F. SUMMARY

The state of the forest in the study area was at various stages of maturity and degradation. Pockets of cultivated land were found in the forests. Given the tertiary sediments of the study area, the instability of this rock type makes the land very sensitive to any disturbance.

What disturbance of the land is occurring in the four village panchayats can be judged from the population and livestock densities in the area. On an average there are 6.83 persons per household, and 7.1 persons per hectare of cultivated land. The average land holding per

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[15]Here reference is made to ruminants only. Pigs and poultry are omitted as they have minimal effect on the green fodder.

TABLE 6

LIVESTOCK OWNERSHIP

Categories	Village Panchayats				Total
	Dasarathpur	Satakhani	Babiyachaur	Kunathari	
Total number of large animals	135	274	209	225	843
Total LSU	156	291	252	260	960
Average number of animals per household	7.9	7.2	8.0	11.8	8.4
Average LSU per household	9.2	7.6	9.7	13.7	9.6

Source: Survey findings.

household at 0.96 hectares in the study area is comparatively lower than the 1.25 hectares per household average for the Hill region. Meanwhile the household size at 6.83 is greater than the 6.5 persons in the Hill area.

Similarly the population growth rate is estimated to be much higher than the average for the Hill region. The eradication of malaria, the availability of the forest land to settle on, and Birendranagar being named the headquarters of the region has provided a pull effect during the past 20 years on the in-migrants to the area. Further population growth can be anticipated with the construction of the road from Surkhet to Jumla as it will further facilitate migration. The demographic momentum inherent in the current age structure in the study area will further accelerate the population growth rate.

What these high population size, density, and growth rate amounts to is the direct increase in the total firewood consumption, the principal source of which is the forest. With the increasing man-land ratio, the present small holdings and the fragmentation of cultivated land that is taking place is unable to support the growing population. The scattered, numerous pockets of spontaneous settlements in the forests is an indication of the encroachment of the forest in an attempt to increase the agricultural land ownership.

In case of the livestock sector, the number of animals per household at 8.4 is nearly double the 4.44 estimate of the bovine population in the Hills. In terms of livestock units, this comes to an average of 9.6 LSU per household. The livestock stocking rate in the study area is estimated to be over ten times the average carrying capacity of 0.31 LSU per hectare in the Hills.

The stress on the forest, the pastures and the farmland to sustain this livestock population is enormous. The inability of these sources of fodder to meet the demand leads to a decrease in the livestock productivity. While livestock is required to sustain the agricultural production, the farmers are compelled to increase their livestock numbers to compensate for the decrease in livestock productivity.

The population and the livestock pressures aside, the lack of any management system is the fundamental problem in the use of the resources (land-forest-water-livestock). Without immediate attention to manage the resource endowments and their use, the high population growth rate and the necessity to keep the livestock beyond the carrying capacity of the land will further deteriorate the ability of the land to sustain the human and the livestock population. In the following chapter, the resource use patterns in the study area are assessed in order to understand what needs to be done to manage the forest resources.

V. FOREST RESOURCE USE PATTERNS

A. INTRODUCTION

The physical and demographic characteristics of the study area were discussed in the previous chapter. Given the high population growth rate and the necessity to keep the livestock beyond the carrying capacity in the study area, it was concluded that resource depletion and land degradation will continue if effective management efforts are not introduced immediately.

In order to appraise the forest resource use pattern, findings regarding the source of firewood and fodder, the time required to collect them, the quantity required, and when they are collected are presented in this chapter. Also findings regarding where livestock are grazed and the duration of grazing are included.

Data regarding amount of timber cut for construction have been omitted. As the interviewees were reluctant to give the information, the data were incomplete and also considered to be of questionable reliability. The respondents generally mentioned that they used timber from old houses and barns in the construction of their new houses.

B. FIREWOOD USE

Source of Firewood

The sources of firewood in the study area are shown in Table 7. In the sample village panchayats the main source of household firewood is the forest (85 per cent) and the remaining 15 per cent comes from private sources (farmland). The use of the forest for firewood in the study area is probably greater than the average conditions elsewhere in Nepal because of the larger household size, the lack of energy alternatives, and the availability of firewood.

On the village panchayat basis as high as 94.7 per cent of the households in Satakhani and Kunathari and 84.6 per cent in Babiyachaur depended on the forest to supply firewood

TABLE 7

SOURCE OF FIREWOOD SUPPLY

Source	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
Own land	8	47.1	2	5.3	4	15.4	1	5.3	15
Forest	9	52.9	36	94.7	22	84.6	18	94.7	85
Total	17	100	38	100	26	100	19	100	100

Source: Survey findings.

with the rest coming from private sources. In Dasarathpur a significantly smaller proportion of the energy requirements came from forest sources (52.9 per cent).

Corresponding to the number of households in Dasarathpur reporting that a greater proportion of their household energy requirements comes from private sources, 41.2 per cent stated that they use cow dung, corn cobs, straw and husk to supplement the deficit in firewood supply. The use of post-harvest agricultural residue for cooking and heating reduces the availability of supplemental feed for the livestock. Burning of cow dung reduces the availability of compost material for maintaining the soil fertility of the farmland.

Excessive demand on the forest resources is leading to an accelerated depletion of the capital stock of the forest itself as there are no reforestation programmes to maintain production. None of the sample households reported use of alternative energy production such as bio-gas or hydroelectricity, nor have they adopted improved technology for the more efficient use of the firewood.

Quantity of Firewood Used

The average annual consumption of firewood in the study area comes to 4973 kg per household (ranging from 4459 kg in Satakhani to 5647 kg in Kunathari). This calculation was based on the daily and the seasonal variation in the firewood use. As shown in Table 8 on average 10.2 kg, 12.8 kg, and 17.7 kg of firewood was used daily per household in the premonsoon, the monsoon and the winter seasons respectively. [16]

The demand for firewood in the winter season was greater by 74 per cent compared to the premonsoon season. In winter additional amount firewood is required for heating. Also firewood to last through the following summer is collected during the winter season. Therefore firewood extraction is greater during this season than during the rest of the year.

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[16]In calculating the annual firewood consumption level, February to May (121 days) was classified as the premonsoon season, June to September (122 days) as the monsoon season and October to January (123 days) as the winter season.

TABLE 8

DAILY TOTAL FIREWOOD USE PER HOUSEHOLD
ACCORDING TO SEASONS

[in kg.]

Seasons	Village Panchayats				Average
	Dasarathpur	Satakhani	Babiyachaur	Kunathari	
Premonsoon	10.6	9.6	9.7	10.8	10.2
Monsoon	14.3	11.3	11.6	14.4	12.8
Winter	18.6	15.6	16.1	21.0	17.7
Annual total consumption per household	5315	4459	4569	5647	4973

Source: Survey findings.

Firewood was reported to be in scarce supply during the months between mid-May and mid-October which corresponds with the monsoon season. Rather than the nonavailability of firewood per se, the scarcity of firewood at this time is due to the labour being tied up in the field work during the monsoon period and because of the lack of dry wood in the forest at this time of the year.

In terms of land ownership categories, a higher percentage of small than other farm size categories reported collecting firewood throughout the year. Large farmers general hire labour to collect firewood required for the whole year between mid-December and mid-June. It is therefore the small and middle farmers who exert pressure on the forest throughout the year compared to the seasonal pressure from the large farmers.

Time Required to Collect Firewood

In the village panchayats surveyed an average of 3.83 hours was required to walk to the forest to collect a load of firewood. Table 9 shows that significantly more time was required to collect firewood in Satakhani (4.7 hours) than in Dasarathpur (3.5 hours), Babiyachaur (3.5 hours) or Kunathari (2.6 hours). Overall, however 48 per cent of the households took three to four hours and another 38 per cent took five hours or more to collect firewood.

More households (92 per cent) in Satakhani, compared to 78 per cent in Kunathari and 65 per cent in both Dasarathpur and Babiyachaur, reported that over the past five years they have had to go further to collect firewood. Despite the lowest level of per household firewood consumption, the northern part of Satakhani was also the only area where there was a noticeable section of degraded forest and overgrazed pasture (Figure 6 in Chapter 3). The concentration of the population in the nothern part of Satakhani and the degradation of the forest there suggests that forest areas closest to the human habitation are depleted most quickly.

According to farm-size groups the small farmers took 3.6 hours compared to 3.8 hours by the middle and 4.0 hours by the large farmers to collect firewood from the forest. Although

TABLE 9

TIME REQUIRED TO COLLECT FIREWOOD

Hours	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
1 - 2	4	23.5	0	0.0	4	15.4	6	31.6	14
3 - 4	6	35.3	12	31.6	17	65.4	13	68.4	48
5 or more	7	41.2	26	68.4	5	19.2	0	0.0	38
Total	17	100	36	100	26	100	19	100	100
Average	3.5		4.7		3.5		2.6		3.8

Source: Survey findings.

the small farmers reported that they spend less time daily than the large farmers to collect firewood they would have to spend more time than the latter on an annual basis. This is because the small farmers collect firewood throughout the year whereas the large farmers collect the bulk of their firewood requirements during the winter. This would mean that the small farmers will have to release a greater amount of family labour to collect firewood than the large farmers. The small farmers, however, can least afford to allocate more labour to household chores without affecting the labour supply for the work in the farm.

C. FODDER USE

Source and Supply of Fodder

Table 10 shows that, overall, during the monsoon season farmland, particularly the terraces, is the principal source of fodder. With the onset of the rainy season, an abundant supply of green plant material is available from the farmland. During the winter season, both sources (farmland and forest) provide fodder. When green fodder is not available farmers resort to feeding their livestock agricultural by-products, particularly crop residue such as husk, straw, stubble, etc. But in the premonsoon season, with the onset of the dry weather and the subsequent depletion of the stock of agricultural post-harvest residue over the winter, the importance of the forest increases as the source of fodder.

Seventy-three per cent of the households reported that they do not get enough fodder supply during the year and that the premonsoon season is the most difficult period. Except during the monsoon season, the livestock are in a semi-starved condition for the rest of the year. The animals become susceptible to disease, and nutritional deficit is the single most important factor in limiting livestock production.

TABLE 10

SOURCE OF FODDER ACCORDING TO SEASONS

Source/Season	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
FARMLAND									
Premonsoon	5	29.4	9	23.7	7	26.9	3	15.8	24
Monsoon	14	82.4	37	97.4	20	76.9	16	84.2	87
Winter	15	88.2	29	76.3	3	11.5	8	42.1	55
FOREST									
Premonsoon	7	58.8	31	81.8	15	57.7	7	36.8	60
Monsoon	4	23.5	10	26.3	4	15.4	2	10.5	20
Winter	9	52.8	23	60.5	23	88.5	13	68.4	68

Source: Survey findings.

Supply and Time Required to Collect Fodder

In the study area, depending on the source and the season, 2.0 to 4.0 hours is required to collect a load of fodder. Eighty-five per cent of the households said that there has been an increase in the time required to collect fodder compared to five years back.

The time required to collect fodder seems to have increased particularly in Babiyachaur and Kunathari where over 94 per cent of the households reported that they have to go further away. The fodder supply in these two village panchayats and in Satakhani (where 84.2 per cent said that they have to go further) may have become a problem in recent years with the depletion of the forest. The respondents in Dasarathpur (where only 58.8 per cent of whom said that they have to go further to collect fodder compared to five years back) have adjusted to the fodder scarcity by relying more on the non-forest based fodder sources. The more predominant practice of stall feeding in Dasarathpur further substantiates this observation.

With this generally insufficient supply of fodder during the year, as perceived by the respondents, the productivity of the livestock is bound to decline. As a consequence there is a need to compensate by adding more livestock beyond the already high stocking rate. The effect is a further increase in the stress on the forest and the farmland, particularly during the winter and the premonsoon seasons, for the supply of fodder.

D. LIVESTOCK GRAZING

The forest is more important for livestock grazing than farmland for most of the year (Table 11). This is particularly true in the case of Babiyachaur where forest is the only place for livestock grazing. The livestock is allowed to graze on stubble on the farm land only after the crop is harvested in October.

Livestock is grazed for an average of 6.66 hours per day. The most intense grazing period is April through June when crop residue from the previous year's harvest would have been consumed and new grasses would not have started to grow on the farmland. In some areas the forest is so overused that grazing has become only a means to give exercise for the

TABLE 11

LOCATION OF LIVESTOCK GRAZING ACCORDING TO SEASONS

Location/Seasons	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
FARMLAND									
Premonsoon	9	52.2	16	42.1	0	0.0	2	10.5	27
Monsoon	1	5.9	5	13.2	0	0.0	1	5.3	7
Winter	2	11.8	12	31.6	0	0.0	1	5.3	15
FOREST									
Premonsoon	9	52.9	28	73.7	26	100.0	17	89.5	80
Monsoon	13	76.5	35	92.1	26	100.0	18	94.7	92
Winter	12	70.6	34	89.5	26	100.0	18	94.7	90

Source: Survey findings

livestock.

Despite the overuse of the forest, stall feeding was not found to be a predominant practice as only 21 per cent of the sample households mentioned that they stall fed their livestock. The variation in such practice in the four village panchayats was found to be significant (at 0.05 level). As high as 52 per cent in Dasarathpur and 26 per cent in Satakhani reported stall feeding of livestock while only seven per cent in Babiyachaur and none of the households in Kunathari reported such practice.

Forty-seven per cent of the households who mentioned that they had adopted stall feeding practices stated lack of pasture/grazing area as a reason for stall feeding their livestock. As the forest area has been generally overgrazed, more households in Satakhani and Dasarathpur have adopted the practice of stall feeding compared to Babiyachaur and Kunathari where forest still provides a grazing area. Other reasons given for stall feeding included: "to increase milk supply", "only sick animals are stall fed", and "because of household work there are no herdsmen to go along".

E. INTERPRETATION

The yearly average firewood consumption in the study area is 4973 kg per household or 739 kg per capita. This is more than 4074 kg per household consumption in the Hills but comparable to 4966 kg consumption per household in eastern Nepal (Campbell, not dated). The annual per capita firewood consumption is also greater among the sample compared to the Hill region in general but less than 829 kg consumption in eastern Nepal. This high rate of consumption of forest resources, without a management programme to sustain the production, will eventually lead to the depletion of the capital stock of the forest itself.

Compared to the premonsoon season the daily per household firewood consumption increased by 74 per cent in the winter season. The demand for firewood in the winter season would be greater not only because more wood is required for heating but also because the firewood requirement to last through the following summer is collected during this time of the

year, particularly by the large farmers.

Depending on the season and the source, 2.0 to 4.0 hours is required to collect a load of fodder. Eighty-five per cent of the sample households said that they have to go further to collect fodder compared to five years back. Similarly 78 per cent of the sample said that there has been an increase in the time required to collect firewood compared to five years back. Any increase in the time required to collect firewood and fodder adds to the already difficult subsistence conditions in the villages. More time also means that more labour is required to collect firewood and fodder and less is available for productive activities.

The Hill farmers have to coordinate all their activities with the agricultural labour demand, particularly during those labour intensive periods of planting, transplanting and harvesting (Bishop, 1976). The labour stress contributes to the escalation of population size in an attempt to obtain an adequate household labour force.

The period between mid-January to mid-May was reported as the time when fodder is difficult to get. The depletion of the stock of the agricultural post-harvest residue over the winter season adds to the scarcity of fodder during this dry period of the year when green fodder is not available. Therefore, the intensity of grazing in the forest increases. The livestock are generally in a semi-starved condition at this time of the year making them susceptible to diseases and reducing their productivity.

The period when firewood is reportedly difficult to get corresponds with the rainy season which is also the time when all available labour is required for field work. It is not the lack of firewood but the labour being tied up in the field work and the lack of dry wood during this rainy season that brings about the perceived scarcity. The observation that the respondents did not perceive firewood supply to be a problem during the winter when the demand is at the peak suggests that the people can still afford the time to collect firewood because of the little labour demand for farmwork at this time of the year.

With the depletion of the forest, as is the case in Dasarathpur, people seem to depend more and more on their farmland to supply the required energy resources. In Dasarathpur, 41

per cent of the sample mentioned that they have to supplement firewood with other sources of energy and 52 per cent mentioned that they stall fed their livestock. Relatively fewer households used other energy sources and stall fed their livestock in the other village panchayats.

The increase in the dependence on the other sources of energy and the adoption of stall feeding have disadvantages although they reduce the pressure on the forest. The use of cow dung as fuel decreases the availability of manure. Stall feeding of livestock increases the amount of labour required to collect fodder and bring it to the animals. However, if the increased labour required for this could be worked out with other demands on family labour, stall feeding could increase compost production through reduction in the loss of manure and urine. Other advantages of stall feeding are the reduction of threats to crops from stray animals and an opportunity to reestablish ground cover in the pastures and the forests.

In general, there is a greater dependance on forest for firewood supply in the study area than elsewhere in Nepal. While 85 per cent of the sample households stated that forest is the main source of firewood, the average for the Hill region is 50 to 53 per cent (Campbell, not dated; Stone, 1980). Given that the firewood consumption is greater and people depend more on the forest to supply the required household energy, the forest in this area may be depleting at a greater rate than in many other parts of Nepal. Similarly, with nearly double the average livestock density in the Hill region, the people in the study area are experiencing a shortage of fodder. Seventy-three per cent of the households said that they do not get enough fodder during the year. Consequently, lopping of the trees leads to defoliation and the long hours of grazing results in additional stress on the land. Considering these pressures, it is quite plausible that Surkhet District is classified as the most ecologically degraded among the 75 districts in Nepal (HMG, 1977; Shrestha, Ginnekin, Sthapit, 1983).

It is evident that there is a spatial and a temporal variation in firewood and fodder source and collection in the study area. While the forest is the major source of firewood throughout the year, there is a seasonal variation between the farmland and the forest as for

the source of fodder. While firewood is most often collected during the winter season, fodder demand and grazing pressure on the forest is greatest during the premonsoon season.

The opinion that firewood supply is not a problem during the winter season when the demand is greatest and the non-adpotion of alternative technology to supplement firewood use or to increase the efficiency, suggests that firewood supply is not yet a serious problem in the study area relative to the definite shortage of fodder.

The following reasons further indicate that the supply of fodder is a greater problem than the supply of firewood:

a. the consensus among the respondents that fodder is most difficult to get during the premonsoon season when the supply is scarce because of climatic factors;
b. the greater amount of time required to collect fodder from the forest than to collect firewood;
c. more households reporting that they have to spend more time to collect fodder, as opposed to firewood, compared to five years back; and,
d. the increased adoption of stall feeding practices and the greater dependence on agricultural post-harvest residue with the decrease in the supply of green fodder.

Now that the findings regarding the patterns of the resource use have been discussed, in the next chapter the extent of pressure these cause in the environment, as perceived by the respondents, is described. The following chapter also looks at the suggestions given by respondents for the management of the forest resources.

VI. PERCEIVED EFFECTS OF DEFORESTATION AND MANAGEMENT MEASURES

A. INTRODUCTION

The effects of deforestation both within the watershed and downstream and its cyclic effects on various spheres of the village life were described in Chapter 2. For the purpose of resource management it is important that such phenomena be also understood by the people affected. This awareness should facilitate the implementation of the resource management programmes.

In the interviews, the respondents were asked first to estimate the change in the forest area in their village panchayat during the past five years, and then to point out the reasons why the forest area had changed if any. After finding out what they perceived to be the effects of such deforestation on their land, the respondents were asked to list what they thought would be some effective measures to manage their forest resources. Queries were also made to find out what has been done both at the community level as well as at the individual level to increase the forest resources and whether they have been effective. Finally, the respondents were asked to suggest what tree species they would like to plant and where they would prefer to plant the trees.

B. PERCEIVED CHANGE IN FOREST AREA

Ninety per cent of the respondents observed that the forest area in their village panchayat has decreased compared to five years back. Another eight per cent said that the forest area had remained the same while two respondents actually thought that the forest area had increased. Earlier, answering the questions regarding changes in the time required to collect firewood and fodder, a majority of the respondents had said that they have to go further compared to five years earlier as a result of the decrease in the forest area.

Although a greater percentage of the respondents in Satakhani and Kunathari compared with the other two village panchayats mentioned that the forest area in their village panchayat

had decreased, the variation among the four village panchayats was not statistically significant. Also in these two village panchayats a greater percentage of households reported that they have to go further to collect firewood compared to five years back.

The general trend in the study area is that the people feel that their forest area is decreasing and consequently is taking increased amount of the available family labour to collect the necessary resources. The reasons given by the respondents as to why the forest area could have decreased are discussed in the next section.

C. REASONS FOR DEFORESTATION

Fifty-nine per cent of the sample households mentioned that it is because of the livestock grazing and fodder collection that the forest area has decreased (Table 12). Increase in population and firewood cutting were also given as reasons by 48 per cent and 42 per cent of the respondents respectively. Other reasons given for the decrease in the forest area included forest fire, lack of reforestation programme, and lack of understanding by the people the importance of the forest.

Uncontrolled livestock grazing and lopping of trees changes the composition and decreases the potentials of the forest and the pastures. Overgrazing of the pastures encourages unpalatable species to take over the vegetation. [17] The increase in population, which was cumulatively the second most important reason given, will have an effect on the amount of firewood demand and also other demands from the forest including the need to increase land under cultivation to feed the people.

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[17]Numata (1983) notes that exotic noxious weeds like *Eupatrium adenophorum* and *E. odortum*, not seen 20 years ago have made a vigorous invasion on abandoned terraces and overgrazed soil. Wormald (1976) makes note of the increase of unpalatable species such as *Daphniphylum himalaynese*.

TABLE 12

REASONS GIVEN FOR DEFORESTATION

Reasons	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
Grazing and fodder collection	10	58.8	20	52.6	18	69.2	11	57.9	59
Increasing population	9	52.9	17	44.7	13	50.0	9	47.4	48
Firewood collection	9	52.9	18	47.4	7	26.9	8	42.1	42
Other	3	17.6	10	26.3	7	26.9	1	5.3	21

Source: Survey findings.

D. RELATIVE DIFFICULTY IN GETTING FOREST RESOURCES

When asked to rank whether it is firewood or fodder that is more difficult to get during the year, 82 per cent of the sample stated that fodder was more difficult to obtain (Table 13). Only six per cent of the households said that it was firewood and the remaining 12 per cent mentioned that both are equally difficult to get. The variation in the response was not significant at 0.05 level in terms of both the village panchayats and the land ownership categories.

This observation is consistent with the conclusions stated in the previous section regarding the main reasons given for deforestation namely the livestock grazing and fodder collection. It is because of the shortage and the difficulty of getting fodder that the pastures and forests are overgrazed and trees are lopped in search of livestock feedstuff. This is thus the principal cause of deforestation.

E. PERCEIVED EFFECTS OF DEFORESTATION

Increased frequency of landslides was perceived as an effect of deforestation by 51 per cent of the sample (Table 14). Twenty-seven per cent of the respondents noticed a decrease in the productivity of their land and 17 per cent felt that there has been a decrease in the availability of water. Increased erosion of land was mentioned as an effect of deforestation by 23 per cent of the sample households. The other effects mentioned were increased flooding, increased temperature, and "land will look ugly". Twelve per cent of the respondents said that they have no knowledge what the effects are.

Only in the cases of those respondents stating that there has been a decrease in land productivity and a decrease in water availability, was there a significant variation (at 0.05 level) in the four village panchayats. More households in Satakhani and Dasarathpur, respectively, cited these two effects of deforestation compared to the other two village panchayats. As these two village panchayats were probably settled earlier than in Babiyachaur and Kunathari, the households have experienced these longer term effects of deforestation. During the survey

TABLE 13

RELATIVE DIFFICULTY IN AVAILABILITY OF FOREST RESOURCES

Resource	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
Fodder	12	70.6	31	81.6	22	84.6	17	89.5	82
Firewood	2	11.8	1	2.6	1	3.8	2	10.5	6
Both	3	17.6	6	15.8	3	11.5	0	0.0	12
Total	17	100	38	100	26	100	19	100	100

Source: Survey findings.

TABLE 14

PERCEIVED EFFECTS OF DEFORESTATION ON LAND

Effects	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
Increased frequency of landslides	13	76.5	14	36.8	14	53.8	10	52.6	51
Decreased land productivity	4	23.5	20	52.6	1	3.8	2	10.5	27
Erosion	3	17.6	6	15.8	10	38.5	4	21.1	23
Decreased water supply	7	41.2	3	7.9	5	19.2	2	10.5	17
Do not know	1	5.9	6	15.8	1	3.8	4	21.1	12
Other	1	5.9	5	13.2	2	7.7	2	10.5	10

Source: Survey findings

extensive sheet and gully erosion was noticed, particularly in these two village panchayats.

The respondents were well aware of the increased frequency of landslides, which are not only immediately visible but which also frequently destroy their farmland and houses and kill their livestock and at times even claim human lives. However they were not aware of the downstream effects of the deforestation in the upper catchments.

F. MEASURES TO MANAGE FOREST RESOURCES

As livestock grazing and fodder collection were stated by the majority of the households as the cause of deforestation and as fodder was stated as more of a problem than firewood by most of the households, questions were asked as to how these problems could possibly be overcome. The respondents were also asked to give suggestions as to how the forest resources, in general, could be managed and what implications the suggested measures would have on the availability of the resources and their use.

Protection from Destruction by Livestock Grazing

"Controlling careless grazing and lopping" was given as a possible way to protect destruction from livestock grazing by 42.3 per cent of the 71 households responding to this question (Table 15). Fencing the forest and making provisions for employing forest guards were the next most frequently mentioned solutions (32.4 per cent of the respondents). Implementation of a reforestation programme and involving the local community in the programme were also cited as solutions by 21.2 per cent and 19.7 per cent of the households respectively. The suggestions made by the respondents in the four village panchayats was not statistically significant.

Other solutions mentioned were rotational cropping/use of the forest area, fire protection measures, reduce dependence on forest for resource supply, and reduce livestock population.

TABLE 15

MEASURES SUGGESTED FOR PROTECTION FROM DESTRUCTION OF FOREST BY LIVESTOCK GRAZING

Measures	Village Panchayats								Total	
	Dasarathpur		Satakhani		Babiyachaur		Kunathari			
	No.	%	No.	%	No.	%	No.	%	No.	%
Control careless grazing and lopping	6	60.0	12	44.4	10	43.5	2	18.2	30	42.3
Fence and forest guards	3	30.0	9	33.3	9	39.1	2	18.2	23	32.4
Reforestation	5	50.0	6	22.2	2	8.7	2	18.2	15	21.2
Community involvement	2	20.0	6	22.2	5	21.7	1	9.1	14	19.7
Rotational use	0	0.0	1	3.7	3	13.0	0	0.0	4	5.6
Fire protection	0	0.0	1	3.7	2	8.7	0	0.0	3	4.2
Do not know	0	0.0	2	7.4	0	0.0	1	9.1	3	4.2
Other	0	0.0	6	22.2	1	4.3	4	36.4	11	15.5

Source: Survey findings

Increasing Fodder Supply

Reforestation (planting of fodder trees) was by far the most frequently cited solution given by the households (Table 16). While 57 per cent gave that solution another 21 per cent indicated that nurseries should be established and seedlings made available for private planting.

Twenty per cent of the households thought that there is a need for a programme to protect the existing forest such that proper use of it is made. The other solutions given were more effective use of post-harvest agricultural residue and rotation cropping.

Measures for Overall Management of Forest Resources

When asked as to how existing forest areas or newly afforested or reforested areas could be protected, fencing and employing forest guards were given as a possible solution by 79 per cent of the households (Table 17). Informing the local people regarding more effective use and better management of the forest resources were also suggested.

The other measures suggested included reforestation and rotational harvest, forest be made individual property, encourage village cooperation in implementing protection measures and controlling livestock free-grazing.

Implications of Suggested Management Measures

First of all there was no statistically significant variation (at 0.05 level) in the measures suggested in the three sections above by the respondents in the four village panchayats, except in the case where none of the sample in Babiyachaur suggested reforestation and rotational harvesting as measures for overall management of the forest.

From these responses the major concern of the villagers seems to be the need to "protect" the resources. Thus they frequently suggested fencing and employment of forest guards. To them this is more of a priority than increasing the supply of the resources, i.e. reforestation. The respondents felt that if one postpones lopping the tree to get fodder for his livestock, it only increases the possibility of another individual doing so before he returns.

TABLE 16

MEASURES SUGGESTED TO INCREASE FODDER SUPPLY

Measures	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
Reforestation	7	41.2	23	60.5	18	69.2	9	47.8	57
Establish nursery	5	29.4	8	21.1	4	15.3	4	21.1	21
Protect existing forest	1	5.9	7	18.4	8	30.6	4	21.1	20
Make effective use of post-harvest residue	0	0.0	5	13.2	1	3.8	1	5.3	7
Other	1	5.9	2	5.3	3	11.5	1	5.3	7

Source: Survey findings

TABLE 17

MEASURES SUGGESTED TO MANAGE FOREST RESOURCES

Measures	Village Panchayats								Total
	Dasarathpur		Satakhani		Babiyachaur		Kunathari		
	No.	%	No.	%	No.	%	No.	%	
Fence & forest guards	12	70.6	32	84.2	22	84.6	13	68.4	79
Educate villagers	4	23.5	2	5.3	4	15.4	1	5.3	11
Reforestation & rotational harvest	3	17.6	4	10.6	0	0.0	2	10.5	9
Other	1	5.9	4	10.6	4	15.4	5	26.3	14

Source: Survey findings

Similarly, restricting his livestock from grazing would only mean that he would lose his grazing opportunity while another household may not only benefit from reduced grazing density but may actually increase his stock. Therefore there is a need to assure the individual that he will eventually be able to use the resources which will be protected from others taking advantage of his restrictive behaviour. In other words, one of the objectives of forest management should be to ensure a sustained supply and a fair distribution of the resources in the community.

This feeling of uncertainty of sustained supply brings about another concern, i.e. the carelessness in livestock grazing and fodder collection. Besides the scarcity of the resources and the identification that the forest area is someone else's (Government's) property, the lack of assurance of using the supply increases indiscriminate grazing in the forest and lopping to death nearby trees. Only if an individual is assured that others in the community will be "made" to cooperate (e.g. through restriction in use by fencing and employing forest guards) will his participation in the reforestation programme be forthcoming.

The respondents have therefore identified the need to involve the community and through extension to explain to the villagers the problems and the objectives of the programme. There should be a campaign to inform and motivate the people to seek their cooperation and participation in the programme.

G. PURPOSE OF MANAGING FOREST RESOURCES

Eighty-nine per cent of the respondents mentioned that some form of management must be implemented in their village panchayat. "Easier availability of the resources" and "assurance of the supply of the resources in the future" were the two main reasons given by the respondents for implementing forestry programmes.

"Easier availability of the resources" as a reason for implementing forest resource management programmes reflects the fact that at present the villagers have to spend more time than they can afford. It may be recalled that the average time the villagers reportedly spent to collect fodder was between 2.0 to 4.0 hours depending upon the source and the season and

similarly the average time required to collect firewood was 3.8 hours daily. The average time within which they would prefer their required resources to be available is 1.1 hour.

Among the middle and the small farmers the concern for "easier availability of the resources" and "stopping of landslides" was significantly greater than the need of an "assurance of the supply in the future". Given their smaller land holdings, the availability of the resources from the private sources is less than what is available to the large farmers. Therefore, their interest is to reduce the time and the labour required to collect the resources and to protect the small farmland they own from landslides. The large farmers, however, not only get more fodder and agricultural post-harvest residue from their larger land holdings, but they can also afford to hire labour to collect the resources.

H. PERCEIVED PROBLEMS IN IMPLEMENTING MANAGEMENT MEASURES

The respondents were asked what they perceived would be the problems when measures suggested to manage the forest resources are implemented. By far the highest number (57.7 per cent) of the 71 households who answered this question said that it would be difficult to get fodder for their livestock and 32.4 per cent mentioned that it will be difficult to get firewood.

Therefore, management plans which currently deprive farmers access to public lands for grazing, fodder and firewood must compensate the farmers with labour saving inputs and employment opportunities in order to get their cooperation. While answering the questions on management measures, the respondents had suggested that deferred rotational harvest should be a part of the management scheme.

Besides these perceived problems related to the continued supply of the resources, 11.3 per cent of the households who answered this question mentioned that it will be difficult to get cooperation from the community in implementing forest resource management schemes. This again relates to the need for the assurance of use of the resources in the future and the need for extension to induce participation by the whole community.

The other problems mentioned included decrease in the availability of manure from the livestock, and more herdsmen will be required. Finally, 9.9 per cent of the sample felt that there will be no problem.

I. MANAGEMENT EFFORTS: COMMUNITY LEVEL

Only 34 of the 100 households interviewed mentioned that some form of forest resource management is being implemented in their village panchayat. It is not surprising that 64 per cent of the respondents in Dasarathpur said that some community efforts are underway because the community forestry programme has been implemented there. Here a panchayat forest area has been demarcated and forest guards employed. The awareness in Dasarathpur (64 per cent) of the Government's programmes for resource management was significantly (0.0042) higher than in Babiyachaur (34 per cent), Satakhani (26 per cent) and Kunathari (21 per cent). The respondents in Dasarathpur mentioned that the programme has been effective in managing the forest resources.

In the other three village panchayats, particularly in Satakhani and Kunathari, the forest area has been fenced under local initiative. This provides evidence of the willingness and the interest of the people to manage their forests. Further study into the evolution of this effort will provide an insight for a workable system of community management.

The community (panchayat) forestry could potentially be an effective programme in these village panchayats for managing the forest resources, given the level of awareness and the perception among the respondents that the programme is effective.

J. MANAGEMENT EFFORTS: PERSONAL EFFORTS

Among the households interviewed 62 per cent reported having planted trees on their property. The response was highest in Dasarathpur where 88 per cent said that they have planted trees which is the positive effect of the implementation of the community forestry programme there.

As for the preference of trees for planting, fodder species were preferred by 85.2 per cent of the 61 households answering this question, followed by the preference for fruit species (75.4 per cent) (Table 18). However preference for firewood species was mentioned by the respondents in Satakhani only, again indicating that the majority of the households in the sample perceived fodder as being relatively more scarce than firewood.

Preference for fruit species ranked second after fodder species. In the past more farmers (82 per cent) had planted fruit trees than fodder trees (79 per cent) but the preference has changed. Although the Hill region has a natural advantage for fruit growing, lack of transportation and marketing facilities have discouraged further expansion of horticulture.

The preferred location for planting was the area around the homestead (Table 19). While 65.6 per cent of the 61 households who answered this question preferred to plant trees around the homestead, and 52.5 per cent said that they would like to plant trees in their farmland, only six percent showed preference to plant in community land.

What was stated above is the general trend in the four village panchayats together. However there was a significant variation (at 0.05 level) in both species preference (between fodder and fruit) and in the preference for location of planting (between homestead and farmland). There was a greater preference for fruit tree species than for fodder in Satakhani while the preference was for the former in the other three village panchayats. There was a greater preference for planting around the household in Babiyachaur and Kunathari while the preference was for planting in the farmland in Dasarathpur and Satakhani. Therefore, as preferences tend to vary in the village panchayats, attention should be paid to the specific needs of the villagers.

There were also those respondents who said that they have not planted any trees. The main reasons given for not planting trees were "no assurance of protection", "no land and/or time" and "no supply of seedlings". These again reflect the uncertainty of using the resources in the future, the scarce labour supply in the villages, and the lack of extension to support interests of the local communities.

TABLE 18

PREFERENCE OF TYPES OF TREES FOR PLANTING

Types of trees	Village Panchayats								Total	
	Dasarathpur		Satakhani		Babiyachaur		Kunathari			
	No.	%	No.	%	No.	%	No.	%	No.	%
Fodder	15	100.0	15	68.2	11	84.6	11	100.0	52	85.2
Fruits	10	66.7	23	95.5	7	53.8	8	72.7	46	72.7
Timber	4	26.7	2	9.1	0	0.0	1	9.1	7	11.5
Bamboo	1	6.7	0	0.0	2	15.4	3	18.2	5	8.2
Firewood	0	0.0	3	13.6	0	0.0	0	0.0	3	4.9

Source: Survey findings

TABLE 19

PREFERENCE FOR LOCATION OF TREE PLANTING

Location	Village Panchayats								Total	
	Dasarathpur		Satakhani		Babiyachaur		Kunathari			
	No.	%	No.	%	No.	%	No.	%	No.	%
Around the house	8	53.3	11	50.0	12	92.3	9	81.8	40	65.6
Farmland	10	66.7	17	77.3	3	23.1	2	18.2	32	52.5
Community land	1	6.7	0	0.0	0	0.0	0	0.0	1	6.7

Source: Survey findings.

K. INTERPRETATION

Most respondents felt that the forest area has been decreasing in the study area, and the principal causes cited were livestock grazing and shortage of fodder. This observation is further substantiated by the fact that the majority of the respondents cited fodder as the dominant problem during the year relative to firewood and preferred to plant fodder species rather than firewood species. The next most frequently cited reason was an increase in population, which will eventually require clearing of the forest to increase the agricultural land. These pressures are changing the composition and decreasing the productive potential of the forests and pastures.

The experience of the local people is that with deforestation the agricultural productivity of their land has declined and there is also a decrease in the availability of water. The former leads to a need to expand the area under cultivation and increase the productivity to feed the growing number of people. In their efforts to increase production from the limited area of land, the farmers in turn keep more livestock for manure and draft power. They may also resort to seasonal migration seeking employment to supplement cash flow or permanent migration to escape the increasingly difficult subsistence farming in the Hill region. On the other hand the decrease in agricultural productivity also results in farmland being adandoned. The decrease in the availability of water increases the family labour required to collect drinking water and stress in livestock watering. Overall, the effect is increased drudgery and hardship for the Hill farmers.

On the other hand these effects, which take a considerable amount of time before they are experienced, compared to landslides, are indicators of the history and the extended state of deforestation in the area. It is not only possible that forest resources in the area have been harvested beyond the replacement capacity for a long time, but the state of deforestation has reached a critical level.

In suggesting measures to manage the forest resources the major focus of the respondents was on the "protection" of the forest area by fencing and employing forest guards

so that "careless" grazing and lopping does not take place. Their concern was to be assured that resources will be available in the future without someone else in the meantime taking advantage of one's voluntary restriction in the use of the forest as part of the management programme. It will not be possible to obtain the cooperation and the participation of the local people unless there is a feeling that others will also be "made" to cooperate so that if one restricts his livestock from grazing in a certain area to allow regeneration, others will not take the opportunity of the reduced grazing density or even increase the livestock numbers - a process which Hardin (1968) referred to as "the tragedy of the commons". It is essential that self-maximizing behaviour in the community be controlled. There is therefore a need for a greater involvement of the local people in the management programmes, and extension efforts must be strengthened to encourage participation by the whole community.

What is evident from the research findings is that the current ineffective resource management practices have worsened the already difficult life of the Hill farmers. However besides the farmers being aware of the problem it is encouraging that this awareness is complemented by their desire that some form of management must be implemented immediately. The awareness of the forest resource depletion is viewed in the context of the impact it has on the everyday life of the people. Deforestation and land degradation becomes relevant when it results in difficulties for the individual and his family.

The major objectives in the view of the local people for the management of the forest resources are "easier availability of the resources" required and "assurance of the supply of the resources in the future".

The farmers' preference for the easier availability of the resources is an indication that they are compelled to spend more time than they can afford or prefer to for collecting the required resources. While their preference was to have the resources available within one hour's distance from the village, at present they spend up to four times that to collect fodder and firewood.

Their concern for the assurance of the supply of the resources in the future is a reflection that the current uncontrolled "careless" pattern of resource use and the lack of effective management will eventually lead to total depletion of the resources they depend so much upon and for which they have not found any alternatives. None of the households reported use of any alternate technology to produce energy or to use energy more efficiently. Stall feeding of livestock is an exception rather than a predominant practice.

Another purpose the people gave as a reason to manage the forest resources was to stop landslides. Increased frequency of landslides was considered to be a major effect of deforestation. Landslide scars on the hillsides are not only always visible but are also reminders of the loss of scarce farmland, livestock, houses, and even human lives.

Easier availability of the resources is a greater concern among the small and the middle farmers than among the large farmers because the former group depends more on the public sources of fodder and firewood requiring more time and labour to collect the resources. The large farmers not only have more fodder and agricultural post-harvest residue available from the large farm holdings but they also hire labour to collect the resources for them.

Meanwhile where the community forestry has been implemented, the people were aware of the programme and expressed their opinion that it has been effective in managing the forest resources. They had personally participated in the programme and planted trees on their private property. This provides concrete evidence of the willingness of the people and further study of the participation mechanism will provide an insight into a workable system of community management.

When there is any restriction in access to the forest after fencing or through employing forest guards, the immediate implications of this as perceived by the respondents were the resulting difficulty in getting fodder for their livestock and the difficulty in getting firewood. The suggestions they proposed to overcome these problems were deferred rotational harvesting such that part of the area is always available and that the farmers who lose access to public lands be compensated through gradual implementation of the management programme.

provision of cutting rights, provision of labour saving inputs, and opportunities for off-farm employment.

Another problem perceived in implementing forest resource management programmes was the possible difficulty in getting the cooperation of the local community. The respondents suggested that first there is need to involve the local communities in all aspects of the programme and second there is a need for a promotional campaign to encourage and induce cooperation and participation.

There was a greater preference for private planting of trees rather than planting in the community area because of the respondents' concern that there is no assurance of protection of trees in the public areas. Such private planting would be easier to protect due to individuals' interest and the feeling of greater assurance of using the produce. The preference for private planting is consistent with the opinion of the respondents who mentioned that the reason they have not planted trees is because of the lack of assurance for the protection.

To be borne in mind is that private planting will benefit farmers in proportion to the land owned. There is a possibility that increased availability of fodder and firewood from private sources for the large farmers will decrease the demand from community sources which would then be available for the small farmers. There is however a need for management programmes to focus on increasing and sustaining the supply of fodder and firewood from public areas and providing equal access to these resources irrespective of the socio-economic status.

In view of the feeling that fodder is the dominant problem in the study area during the year, compared to firewood, the respondents revealed a preference for planting fodder species. Only the respondents in Satakhani expressed preference for firewood species but still the preference ranked third after fruit and fodder species. This preference for fodder species further substantiates the observations that shortage of livestock feedstuff is the main cause of deforestation in the study area.

The respondents reported that in the past they had planted more fruit trees than other species but for future planting they prefer fodder trees. [18] In reference to the comparative advantage of the Hill region, planting of fruit trees had been widely encouraged. However, lack of transport and market facilities have discouraged the villagers from growing more fruit trees. Fruit trees still ranked second in preference for future planting because horticulture programmes have the potential for increasing farm income including that of small farmers, could contribute to increasing nutrition in the diet, and increase overall employment.

Irrespective of whether the village panchayat was classified as in a "low" or "high" level of deforestation, or whether the household size was larger in one than the other, it was still the livestock stocking in relation to the carrying capacity of the land that was perceived as the principal cause of deforestation in the area. This is contrary to the management priorities currently being advocated by the proponents of the "other energy crisis" (i.e. the firewood scarcity in the developing countries). The focus has been on the alleviating the firewood scarcity to control deforestation.

The shortage of fodder is also a food shortage problem as it has a serious effect on the entire agricultural system. Livestock is the key link in the farming ecosystem because it acts as a means of collecting, concentrating and breaking down large amounts of plant material to provide food for the people and also dung for composting and recycling (ADB/HMG, 1982). Livestock compost in many cases is the only means of replenishing the soil nutritients. Livestock is also a major source of power for soil tillage, threshing and rural transport.[19] Consequently with the decrease in the livestock productivity, crop yields have declined and the agricultural production is unable to meet food requirements of the growing population. Therefore, the respondents ranked increasing population as the second most important reason

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[18]A similar preference was shown in a study by Bhatta *et al.* (1977). "Villagers want to plant firstly fruit trees and/or fodder trees on their private land, secondly fodder trees and/or firewood species on the communal land...". Also Calkins (1982) and Nepali (1977) have argued in favour of promoting horticulture development in the Hills.

[19]In addition, livestock provides essential items of subsistence food for the farming community (milk, *ghee*, meat), items for trade (*ghee*, live animals), and raw materials for cottage industries (wool, milk, hides).

for deforestation after livestock grazing and fodder collection but before firewood collection.

In the traditional farming system in the Hills, livestock, forestry and crop production and household subsistence are very closely integrated. The farm ecosystem is relatively self contained, each sector supporting the other. Unfortunately the contraction in the fodder supply has not led to a decrease in the livestock number; rather, the tendency is towards increasing the number to compensate for the decline in the productivity of individual animals. Wyatt-Smith (1982) is right in concluding that shortage of fodder is the weakest link in the farming system.

VII. CONCLUSIONS AND SUGGESTIONS

A. CONCLUSIONS

This study has shown that excessive livestock grazing and shortage of fodder are the principal reasons for the perpetuation of deforestation and land degradation in the study area. This has led to overgrazing, defoliation and lopping of trees around the homestead, farmland, pastures and forests. With the subsequent decrease in the livestock productivity there has been a shortage of the traditional compost material to replenish soil nutrients. The infertility of the agricultural land will leed to abandoning of the terraces, exposing them to erosion. Another consequence is that more marginal and forest areas are brought under cultivation in an attempt to feed the increasing population.

Although evidently livestock overgrazing and fodder scarcity are the principal causes of deforestation, the symbiotic relationship between the whole farming system shows that attributing deforestaion to a sole independent variable would be simplistic. The question of firewood supply is crucial too and cannot be understated for without alternatives to household energy requirements, firewood extraction will also continue to cause deforestation. Shortage of firewood supply has diverted the traditional source of compost material to cooking and heating needs.

The supportive roles between the various components of the agro-forestry system and the interlinkages of the range of people, activities and places involved, suggests that programmes for conservation without the inclusion of the total farming system (agriculture, forestry, horticulture, livestock, water management, extension, marketing, transport) is unlikely to meet with any significant success.

The current realization that fodder is a greater problem and the major cause of deforestation relative to forest clearing for agricultural land expansion or firewood collection, interestingly points out the evolution of the deforestation process. In the past, both expansion of farmland by cutting down the forest to produce more food and cutting firewood to cook the

food resulted in deforestation. Now because of the lack of forest to feed the livestock, the productivity of the land has declined and there is less food to cook and less firewood to cook with. The farmland infertility is leading to more land being abandoned than forest areas being cleared for cultivation.

Related to the need to focus attention on fodder supply is the finding that there is a spatial and a temporal variation in fodder and firewood sources and collection in the study area. While the forest is the major source of firewood throughout the year, there is a seasonal variation between the farmland and the forest as the source of fodder. While firewood is most often collected during the winter season, fodder scarcity and grazing pressures on the forest are greatest during the premonsoon season. Forest management programmes must take into account the need to increase the supply of the resources at the time of scarcity or greatest demand. There is a definite need to particularly increase the supply of fodder from the public sources (i.e. the forest) to supplement the supply from the farmland.

It must be added that the small and the middle farmers (i.e. 74 per cent of the sample households) depend much more on the public sources for the supply of fodder and firewood compared to the large farmers who are able to meet most of their requirements from the private sources if need be. Although management programmes should favour the underpriveledged, such an approach where one group is favoured over the other will not be successful. There is a definite need to get the cooperation of the large farmers who are the ones who influence the village decision making process. Making provision for equal access to the public resources irrespective of the socio-economic status will have a better chance of success in programme implementation and greater assurance of increasing the supply for the small and the middle farmers.

B. SUGGESTIONS

Given the awareness, the interest and the opinion that the community forestry programme has been effective in managing the forest resources, there is a potential for replicating the programme in other village panchayats as well. Based on the findings of this study regarding the patterns of the forest resource use, the preferences mentioned and the management suggestions given by the respondents, a range of alternatives for the specific aspects of the implementation of the community forestry programme has been developed and summarized in Table 20.

In Table 20, the management alternatives are summarized in four sections, namely:

a. *Increasing the forest resource supply* through reforestation programmes and establishment of nurseries for distribution of seedlings. The preferences of the people regarding the species of trees and location of planting are outlined later.

b. *Decreasing the forest resource demand* through reduction in livestock population, human population, and decrease in dependence on the forest. The stress is on the need to convince the people that quality not quantity of the livestock is the criterion of wealth, both for the family and its following generations. The possibilities of developing a number of alternative renewable sources of energy are listed.

c. *Protection measures* include fencing, employing forest guards, controlling careless use and protection from fire. There are a number of options in methods of protecting the forests which involve varying costs and social discipline requirements.

d. *Institutional aspects* for implementation like types of community forests provided in the current legislation, need to involve the local communities particularly the women, and the incentives and compensation which could be provided are listed.

The specific suggestions regarding each of these sections are listed below.

TABLE 20

RANGE OF ALTERNATIVES FOR FOREST RESOURCE MANAGEMENT IN THE HILL REGION

I. INCREASING SUPPLY	II. DECREASING DEMAND	III. PROTECTION MEASURES	IV. INSTITUTIONAL ASPECTS
1. Reforestation Programme a. types of trees/grasses: -fodder -fruit -firewood -legumes b. location of planting: -homestead -farmland -waste land -community land c. species selection: -multi-purpose -fast growing 2. Establish Nursery a. purpose: distribution of seedlings b. location of nursery c. stocking with preferred species d. employment opportunity	1. Reduce Livestock Population a. direct method: -culling b. indirect methods: -genetic improvements -reduce loss due to disease -improve nutrition -castration -replacement -tax on number of animals owned -user fees for pastures 2. Decrease Dependence on Forest a. family planning to reduce population growth b. alternate fodder supply: -more effective use of agricultural post-harvest residue -storage of grass c. efficiency in use: -improved stoves d. alternative energy sources: -bio-gas -hydroelectricity -solar and wind power	1. Fence a. methods: -barbed wire -stone wall -"live" fencing -"social" fencing 2. Forest Guards 3. Control Careless Use a. methods: -stall feeding -grazing management -improvement in tools -hand harvesting 4. Protection from Fire	1. Community Forestry Programme a. types of community forests: -panchayat owned -panchayat protected -leased b. compensation for loss of access to traditional source of resources: -grass cutting rights -time saving inputs -rotational harvest 2. Community Involvement a. formation of user groups b. incentives: -appreciated "felt" need projects -demonstration and replication c. involvement of women 3. Community Education/Extension

Increasing Forest Resource Supply

1. Reforestation Programmes

   1) The focus of reforestation programmes should be on increasing the fodder supply from around the homestead, farmland and waste land within the cropping area to be supplemented by the supply from the forests. Besides green fodder trees, improved grasses and legumes should be planted on bunds and terrace slopes.

   2) Appropriate areas of forest close to the village should be managed to provide fodder and as community pastures.

   3) Fruit trees must also be made available for planting in the private property as per the interest of the people.

   4) Efforts to increase forest resource supply (both fodder and firewood) should be directed particularly towards the winter and the premonsoon seasons when the demand is the greatest.

   5) Forests more distant from the village should be managed as Panchayat Protected Forest for the purpose of supplying firewood and timber.

   6) There is a need to search for multipurpose, fast growing species and improved grass species suitable for the specific region.

      A naturally fast growing multipurpose specie is ipil-ipil (*Leucaena leucacephala*) which is being tested in various parts of Nepal. Acacias, Albizias and Bauhinia have also shown prospects as good legumes and for multiple use. Improved grass species like Setaria and Desmodium have been found to be very suitable for the Hill Region (DSCW, 1983; Hopkins, 1983; IBRD, 1978; Pandey, 1982; Rockefeller Team, 1976; Shah, 1980).

   7) Farmers tend to regard as good fodder anything the animals will eat. In selecting tree and grass species for planting, consideration must be given to productive capacity (fodder, firewood, poles, fruits/nuts, etc); availability (long/short period, winter/summer seasons); tree growth habit (fast/slow); regeneration

capacity; site suitability; resistance (drought, pest); palatability; chemical composition (nutrition); etc.

8) In promoting tree plantation in the cropland, the upper limit of the standing tree per unit area must be respected as crop yields can be reduced by lateral spreading of roots and by shade. Pandey (1982) believes that farmland could take up to at least further 20 trees per holding.

9) Extensive gully and sheet erosion was noticed in the study area during the field work. This was true even in the forest where because of overgrazing the under growth of vegetation has been removed. Heavily grazed land tends to be highly prone to soil erosion in almost every case and is the greatest contributor of sediments in a catchment basin (Carson, 1981). A single layer of tree cover, devoid of understory, does not provide adequate protection of reducing rainfall impact on the soil surface. To overcome this neglected aspect in the current forest protection programmes, attention must be also paid to increasing grass cover and undergrowth to protect the soil in the reforested areas.

10) The continuation of supply of the forest resources can be guaranted only if forest products are harvested in a judicious manner allowing regeneration. To assure sustained yield the first principle in practical forestry is that only the annual increment put on the trees should be removed such that the actual forest area remains constant (Kayastha, 1970).

2. Nursery Establishment

1) A village panchayat nursery or even temporary ward level nurseries should be established. They must be stocked with locally preferred species.

2) The possibilities of providing employment to the local people should be explored.

3) To the greatest extent possible the nursery should be located as close to the areas of plantation as possible to reduce transport loss and cost. Proper health and size of the seedlings must be ensured before distribution in order to reduce seedling

mortality. These have been the two principal causes of seedling mortality in the current reforestation programme (Campbell and Bhattarai, 1983).

Decreasing Forest Resource Demand

1. Decrease Livestock Numbers

   1) As the livestock stocking in the area is beyond the carrying capacity of the land, there is a need to decrease the livestock numbers. With livestock forming such an integral part of the farming system and because of the evident social reactions, direct measures like culling unproductive animals will not be acceptable. Similarly introducing taxation on the number of heads of animals or charging user fees will be difficult to implement.

      The alternative is to increase the livestock productivity through genetic improvement, reduction in losses caused by diseases, improvement in nutrition, and castration of scrub animals and young males not needed for breeding. The argument here is to convince the farmers the possibilities of improving the quality of the stock for better productivity.

   2) There is also the option of progressively reducing the goat population as they do considerable harm to the vegetation. The possibility of replacing cattle by buffalo should be looked into. For religious reasons, it is not permissible to slaughter cows but buffalos are slaughtered. To be considered are the dietary restrictions of the local ethnic groups. Magars will eat pigs but not buffalo and it is viceversa in case of the Gurungs and the Newars.

2. Decrease Dependence on Forest

   1) To decrease the demand on the forests, there is a need to promote family planning programmes to control the population growth rate.

   2) As fodder is a greater concern than firewood, efforts to substitute household

energy or improve efficiency in use will be slow in adoption. Rather the possibilities for the storage of green fodder from the monsoon season for use during the following months when the fodder supply gets scarce, should be researched.

3) In developing alternative energy sources, attention should be given to finding the least cost solution for power generation in a given area and to the operation and maintenance requirements. Financial constraints make it essential that the schemes be cheap, but cheapness must still include durability and reliability. There is also a need for multi-purpose utilization including coordinated development for demand creation. Energy produced could be used for many purposes like irrigation, water supply, agro-processing, and household energy.

Protection Measures

1. Fencing

   1) One of the early prerequisites in the demarcation of community forests is the assurance of protection. As much of the perimeter protection as possible should be in place before planting seedlings in protected areas.

   2) As for the fencing material, natural "live" fencing of inedible fast growing shrub has been found to be cheaper and as effective as constructing stone walls or erecting barbed wire fences. Barbed wire is expensive and difficult to get. Where materials are available stone walls have proven to be a cheap and durable solution for keeping away cattle but they are not sufficient protection from goats.

   3) Fencing seems to cause irritation in the community depending upon their acceptance of the management plans. This dislike can only be overcome through a considerable degree of self-discipline and cooperation by the entire village. [20]

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[20]Bhatta *et al.* (1977) and Wormald (1976) mention that when the villagers are convinced that a forest needs protection from grazing, they are capable of imposing their own control measures.

4) The respondents suggested that forest guards should be employed to patrol the forests. However the forest guards are also often considered as "policemen" stopping access to the resources. Changing this attitude among the villagers about the forest guards will take time.

2. Control Careless Use

1) As "careless use" and "grazing" are important concerns of the people, practices of hand harvesting and stall feeding should be encouraged. There is a need to change the age-old scavenging practices to a more organized system of hand harvesting. The possibility of encouraging some sections of the community to specialize in collecting fodder and firewood to be sold to the villagers should be looked into.

2) Advantages of stall feeding include reduction of threats to crops and increased compost production through reduction of loss of manure. Furthermore stall feeding will ensure reestablishment of ground cover and palatable fodder species will not be eaten out. It has also been found that it is possible to produce more fodder per unit area of land compared to grazing in the same area of land (Hopkins, 1983). [21]

3) Stall feeding will reduce labour required to herd livestock further away from home but there will be an increase in labour requirement as fodder will then have to be cut and carried to the animal. This requirement must be worked out with other demands on family labour.

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[21]Wyatt-Smith (1982) mentions that there is a possibility of increasing fodder production from 1200 kg/hectare/year and 2000-3000 kg/hectare/year under unmanaged conditions to 6000 kg/hectare/year and 5000-7000 kg/hectare/year from the pastures and the forests respectively.

Institutional Aspects

1. Community Forestry Programme

   1) Extensive areas of forest (as shown in Figure 7) could be handed over to the local communities as Panchayat Forest and Panchayat Protected Forest. Given the interest and the willingness of the people about the community forestry, the current slow pace of demarcation could only be due to administrative reasons.

   2) The steps involved in implementing Panchayat Forest and Panchayat Protected Forest would be: selection of areas for plantation and of existing forest for management, establishment of nursery, demarcation and protection, plantation, weeding and harvesting. Site selection should complement established and future water use projects, livestock programmes and conservation works. Demarcation must take into account the needs of the people like access to water for livestock and through-ways.

   3) Management plans that deprive farmers of access to public land for fodder and firewood, need to compensate these farmers with labour-saving incentives and employment opportunities in order to get their cooperation. For example, grass cutting rights could be first given to those who lost grazing land. The small farmers could be provided with off-farm employment in conservation activities as a compensation. The extra labour that would be required to collect the forest resources, could be compensated by time-saving inputs such as implementation of drinking water projects.

   4) The respondents have suggested that step-by-step planting and deferred rotational harvesting should be promoted. In plantation areas wood may be harvested no sooner than five years and fodder a little earlier but grass could be cut from the first year. Pastures could be divided into several plots and grazing permitted on rotation allowing time for reclamation. [22]

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[22]For example, Wormald (1976) reports of certain villages where forest area has been divided into 10 or more blocks and one block is closed at a time until regeneration is well established.

5) When the community forestry programme is fully operational the local communities will benefit through increased resource supply, protection of soil and water sources, employment opportunities, and saved labour. Immediately, however, there will be greater pressure from livestock (overgrazing of pasture, crowding, pressures on crop and crop residues) and increased labour requirement for hand harvesting, collecting firewood and grazing livestock at a greater distance.

2. Community Involvement

1) As production from a reforestation programme is latent, to encourage the rural people to participate and to encourage them to strengthen their institutional and administrative skills, an incentive programme should be designed.

One such incentive would be to piggy-back the forestry programme, which has a long gestation period before benefits can be realized, with the much more appreciated public works projects such as irrigation and drinking water supply systems, provision of new seeds, agronomic techniques, etc. Through these projects, farmers could reap some high priority short-term benefits in compensation for some of the immediate loss from forest enclosures. Moreover there is the possibility of increasing productivity and the standard of living .

2) Another alternative to motivate the Hill farmers in participating in forestry programmes is through demonstration. As the success of the new management scheme or new technology (improved species, improved cooking stoves, alternative energy sources, etc.) is proven, people from outside the area can be brought in with the objective of replicating the success in their own villages. The advantage of a demonstration process is that systems are more likely to be replicated if they evolve from a reality-led selection process rather than being driven into our lives by their technical appeal alone (French, 1979). However the replication of a certain activity from one place to another will only take place if

the farmers who participated in the programme are truly seen to be better off than before the implementation of the programme.

3) To generate community participation and manage both the forestry and the incentive program, some form of community organization is required. Effective institutional means which can assure a maximum of group action or locally generated cooperation among the farmers, is likely to be the cheapest means for the Government to implement development programmes.

   In that line, it is suggested that the formation of user groups be encouraged. These groups can be locally generated or government intiated or both. In some areas traditional systems could be reactivated, reinforced or improved while in other areas a system will have to be introduced afresh. In forming these groups it is essential that the programmes for which such groups are formed accrue equal benefits to all the members. Equally essential is that the small farmers be included in the decision making process.

4) Another aspect regarding community participation, is the need to involve the women in the management programmes. It is quite logical that the women, who are not only the main fuel and fodder collectors but also the ones who cook the food and take care of the animals know very well which tree species are best to grow for fuel and fodder (Werner, 1981). The women should be urgently informed about the meaning of community forestry and be involved when talking about introducing stall feeding and growing new grass species.

   Many authors have suggested that female extension workers should be trained to develop effective communication with village women and to transfer technology to the local level (Acharya and Bennett, 1981; Bhattarai and Karmacharya, 1981; IDS, 1983; Schroeder and Schroeder, 1979; Shrestha and Apedaile, 1984). At present extension workers are all male and their training neither encourages nor do social norms permit much contact with women.

Another option is to foster their participation in user groups. A minimum representation by female members of the society could be made compulsory in forming user groups. It has been found that through encouragement and provision of opportunities to participate it is possible to mobilize the women in development activities.

3. Community Education Programmes

1) The respondents felt that it will not be possible to protect newly reforested and afforested areas because it will be difficult to get community cooperation. The people are under pressure of subsistence on a day-to-day basis. As a result concepts like investment, conservation, protection are not affordable and little appreciated. Therefore a massive educational campaign to explain to the people the need to preserve the environment, its importance in attaining a better standard of living, and need to adopt appropriate land use practices will have to be a part of the management scheme.

Finally, to conclude, the objectives of these management measures are to optimize the human welfare, while at the same time maintaining the balance of the ecosystem and minimizing irreversible environmental perturbation. More specifically, the expectation is that through these management measures there will be:

a. an improvement in the daily livelihood of the Hill farmers;

b. an improvement in the balance between man and the environment to assure sustained supply of resources (forest, land, water) for future generations;

c. land restoration for stability and continuity of the natural resources;

d. reduction in soil loss on-site (watershed degradation) and reduction in flooding, siltation off-site (downstream externalities);

e. increase in and sustained supply of fodder for livestock, firewood for cooking and heating and water within reasonable distance from the village;

f. an enhancement in community organization.

Achieving these indeed complex and difficult goals is not going to be without social costs and various constraints. The survey respondents felt that immediately there will be no place to graze livestock or gather fodder and firewood, more herdsmen will be required, etc. Again, being solely dependent on the forest for the supply of the resources, these immediate repercussions will have to be compensated. Given the lack of options for diversification the people in the Hills will continue to depend on agriculture and on the other associated sectors for their living.

There are also numerous constraints which will have to be overcome. Social and religious customs prohibit slaughter of cattle that have completed their economic life yet there is a need to reduce the livestock population. Information on silvicultural aspects specific to the conditions in Nepal is rudimentary. The archaic rights entitle the villagers to a daily head-load of fodder and firewood (Wyatt-Smith, 1982). The village custom of free-grazing and the belief that burning improves grazing is deeply ingrained (Wormald, 1976).

Furthermore, either there is no institutional structure for the management of the forest at the local level or it is very weak. There is also a lack of training of the local people in techniques and management of forest resources. The still prevailing attitude that it is the Government's responsibility to manage the forest and the finding in this study that the farmers hesitate to invest anything themselves for fear of someone else harvesting the fruits of their labour will be slow to change.

However, the mitigating factor is that despite all these constraints the people are aware of the need for rehabilitating and reinstating the forests. There is an overall institutional basis which can potentially pave the way for effective community forestry management.

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APPENDIX - I

BEHAVIOUR AND ATTITUDE OF NEPALESE HILL FARMERS

TOWARDS FOREST RESOURCE USE AND CONSERVATION

HOUSEHOLD SURVEY

[SURKHET DISTRICT: DASARATHPUR, SATAKHANI, BABIYACHAUR, KUNATHARI]

May - June 1983

Village panchayat:_____

Ward Number:_____ Household Number:_____

Interviewer:_____

Date:_____Time: from_____to_____

[TRANSLATED FROM NEPALI]

1. How many of the following livestock do you own?

   A. cattle ☐
   B. buffalo ☐
   C. goats ☐
   D. sheep ☐

2. Where do you graze your livestock during these seasons?

	Premonsoon	Monsoon	Winter
A. own land	☐	☐	☐
B. other's land	☐	☐	☐
C. community pasture	☐	☐	☐
D. forest	☐	☐	☐

3. For how long is the livestock grazed everyday?

   A. _____ hours

4. Do you keep any livestock on stall feeding?

   A. yes ☐
   B. no ☐

   4.1 Why do you keep your livestock on stall feeding?

   _____

   _____

5. How many loads of fodder do you collect from:

	Premonsoon	Monsoon	Winter
A. own land	☐	☐	☐
B. forest	☐	☐	☐

6. How long does it take to collect a load of fodder from:

	Premonsoon	Monsoon	Winter
A. own land	☐	☐	☐
B. forest	☐	☐	☐

7. Do you get enough fodder to feed your livestock?

A. yes ☐

B. no ☐

7.1 In which month/s is it difficult to get fodder?

_____

7.2 What do you do when enough fodder is not available?

_____

8. Do you have to go further, same or less distance to collect fodder compared to five years back?

A. further ☐

B. same ☐

C. less ☐

9. How many loads of firewood is required for your household every day?

   A. _____ loads

10. From where do you get your firewood?

   A. own land ☐

   B. forest ☐

11. How long does it take to go to the source of your firewood supply?

   A. _____ hours

12. In which month/s is firewood most often collected?

   A. _____

13. In which month/s is firewood most difficult to get?

   A. _____

14. Do you have to purchase firewood for your household needs?

   A. yes ☐

   B. no ☐

   13.1 In which month/s do you have to buy firewood?

   _____

15. Do you have to go further, same or less distance to collect firewood compared to five years ago?

   A. further ☐ C. less ☐

   B. same ☐

16. What other sources of energy do you use?

A. gobar gas ☐

B. cow dung cakes ☐

C. husk ☐

D. corn cob ☐

E. other: _____

17. Did you build a new house during the past five years?

A. yes ☐

B. no ☐

18. How often do you change the thatched roof on your house?

A. _____ years

19. From where do you get the thatch?

A. _____

20. During the year is it more difficult to get firewood or fodder?

A. firewood ☐

B. fodder ☐

C. both ☐

21. Has the forest area in your village increased or decreased during the past five years?

A. increased ☐

B. same ☐

C. decreased ☐

21.1 Why has the forest area decreased?

A. change to agricultural land ☐

B. free grazing of livestock ☐

C. cutting trees for firewood ☐

D. cutting trees for fodder ☐

21.2 Why has the forest area increased?

_____

22. What happens to the land when forest is destroyed and pastures overgrazed?

_____

_____

23. What is the reason for the forest and pasture being destroyed?

_____

_____

24. Some people say that livestock grazing freely in the forest and the pastures are a cause for destruction of land. Do you agree?

A. yes ☐

B. no ☐

24.1 What should be done to protect the forests and the pastures?

_____

_____

24.2 What problems could possibly arise while implementing such programmes?

_____

_____

25. Do you think that increasing fodder supply would help in controlling land from being destroyed?

A. yes ☐

B. no ☐

25.1 How could the fodder supply be increased?

_____

_____

25.2 How could plants be protected from being destroyed by people and livestock?

_____

_____

26. In the past year did you plant any trees around your house, field or in the forest?

A. yes ☐

B. no ☐

26.1 Are there any reasons why you did not plant any trees?

_____

_____

26.2 Would you like to plant trees?

A. yes ☐

B. no ☐

26.3 Where would you like to plant trees?

A. around the house ☐

B. in the farm land ☐

C. in community land (barren land, forest) ☐

26.4 What kind of trees would you like to plant?

A. fruit ☐

B. fodder ☐

C. firewood ☐

D. timber ☐

E. bamboo ☐

F. other varieties: _____

26. continued

26.5 Where did you plant the trees?

A. around the house ☐

B. in the farm land ☐

C. in community land [barren land, forest] ☐

26.6 What kind of trees did you plant?

A. fruit ☐

B. fodder ☐

C. firewood ☐

D. timber ☐

E. bamboo ☐

F. other varieties: _____

27. Are there any specific practices in your village/panchayat to protect the existing forests and pastures?

A. yes ☐

B. no ☐

27.1 Should something be done to protect the forests and the pastures?

A. yes ☐

B. no ☐

27.1.1 What should be done?

_____

_____

27. continued

27.2 What practices exist?

_____

_____

27.3 Have they been effective?

A. yes ☐

B. no ☐

28. Have you heard of the Government's efforts to develop community forests?

A. yes ☐

B. no ☐

28.1 Do you think it is a good idea to have such protected forests?

A. yes ☐

B. no ☐

28.1.1 Why not?

_____

_____

28.1.2 Why yes?

_____

28.1.3 Within what distance should such forest be set aside?

_____

29. Have you personally done anything to plant trees or protect the forest and the pasture?

A. yes ☐

B. no ☐

21.1 Why not?

_____

_____

21.2 What did you do?

_____

_____

30. What is your occupation?

A. farming ☐

B. service ☐

C. business ☐

D. labourer ☐

E. other: _____

31. How much land do you own?

type of land	area
A. khet	☐
B. gharbari/pakho	☐
C. kharbari	☐

32. How many members are there in your household in the following age groups?

Age groups	Male	Female
A. 0 - 4	☐	☐
B. 5 - 9	☐	☐
C. 10 - 23	☐	☐
D. 24 - 29	☐	☐
E. 30 - 59	☐	☐
F. above 60	☐	☐

33. What is your caste/ethnic group?

A. Brahmin ☐
B. Chetri ☐
C. Newar ☐
D. Tamang ☐
E. Gurung ☐
F. Magar ☐
G. Gurung ☐
H. Sanyashi ☐
I. Other: _____